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GREATER TORONTO AREA 3Rs ANALYSIS

COST TECHNICAL APPENDIX

DRAFT - NOVEMBER 1993

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for
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Ministry of Environment and Energy

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1.0 INTRODUCTION

1.1 Background

In 1989, the government of Ontario announced its commitment to meeting a Provincial target of at least 50% reduction of waste going to landfills and incineration by the year 2000. This target, a waste **diversion** target to be achieved through waste reduction, reuse and recycling (the 3Rs) was confirmed by the present government in 1990.

To facilitate the achievement of the 50% target, the Province introduced the *Waste Management Act, 1992*. The Act broadens the government's powers to reduce waste sent to disposal through a variety of means. It also vests powers in the Interim Waste Authority (IWA), an agency created to ease the waste disposal crisis in the Greater Toronto Area (GTA). The IWA is complying with its mandate by conducting environmental assessments to locate three, long-term landfill sites in the GTA.

The GTA Regional Municipalities of Peel and Durham are each defined for the IWA process as separate "primary service areas". Metropolitan Toronto and the Regional Municipality of York have been defined as a separate **combined** primary service areas. Each of the three defined primary service areas are proposed to receive one new landfill facility identified through the IWA's process. The fifth GTA Regional Municipality, Halton, has already obtained approval for a landfill site and thus is not part of the present siting process.

1.2 Purpose of Study

This study has two purposes, each of which relates directly to a requirement created by the *Waste Management Act*.

The first requirement pertains to waste estimates. Section 14 of the *Waste Management Act* requires the Minister of Environment and Energy to provide a written estimate as to:

a) *the amount of waste that would otherwise be expected to be generated in the primary service area (i.e. each of Peel, Durham and Metro/York) during a twenty-year period that will not be generated because of waste reduction efforts; and*

b) *the amount of waste that will be generated in the primary service area during a twenty-year period that will not need to be disposed of in the site because of the reuse or recycling of materials that are or could become waste.*

These waste estimates were provided to the IWA by Minister's letter dated May 15, 1992. The current study provides additional analysis of 3Rs activities, in support of the waste diversion estimates previously provided.

The second requirement pertains to analyzing the 3Rs as "alternatives to" landfill waste disposal sites. Section 15 of the *Waste Management Act* requires that the IWA environmental assessments contain a description of, and statement of rationale for the 3Rs, as well as evaluate matters relating to the 3Rs as an alternative to the landfill waste disposal sites. By administrative agreement, MOEE committed to provide such a rationale and evaluation to the IWA for use in its environmental assessments. The present report fulfills this second requirement.

1.3 Study Approach

The GTA 3Rs Analysis identifies and assesses alternative 3Rs systems, comprised of combinations of 3Rs programs, technologies and practices, that could reasonably be implemented in the GTA. It also determines the potential for each 3Rs system to divert waste over the twenty-year minimum life expectancy of the GTA landfill sites, and identifies the advantages and disadvantages of each system.

For purposes of the present analysis, an array of conceptually different 3Rs systems have been identified for addressing residential wastes, as well as for industrial commercial, and institutional (IC&I) wastes. For each system, estimates of the amount of waste the system could potentially divert from disposal have been determined. An assessment, done on a non-site-specific, generic level and documented in this report, identifies the advantages and disadvantages to the environment of each potential 3Rs system, in keeping with the *Environmental Assessment Act*.

In conducting the 3Rs work, and providing estimates of waste that will not require disposal in the IWA established sites, MOEE is acting as a reliable authority in accordance with its legislative mandate, and not as the proponent or co-proponent of any of the 3Rs systems discussed. The alternatives presented in this report are not in any way structured as detailed implementation plans for the Regions or the private sector.

1.4 Purpose of the Cost Assessment and Study Objectives

This technical appendix documents the cost input into the GTA 3Rs analysis. Cost effects in this study are defined as potential for alterations to existing system costs which may occur as a result of the implementation of a 3Rs system within each of the four Regional municipalities (Durham, Metro Toronto, York

and Peel). The results of this assessment serve as input into the overall 3Rs system evaluation.

The study objectives of the cost assessment are as follows:

- Identification of existing waste management costs in each of the four regional municipalities;
- Prediction of cost effects as a result of implementation of any of the alternative 3Rs systems within each of the four Regional municipalities;
- Analysis of the potential effects on cost, including the development of mitigation measures for the purposes of identifying net effects;
- Ranking the systems of the four Regional municipalities from the perspective of cost.

1.5 Outline of Report

Chapter 2 presents the study approach followed in the Cost assessment.

Chapter 3 presents residential system cost estimates for existing and alternative systems for the Regions of Durham, Metro Toronto, York Peel and Halton.

Chapter 4 provides IC&I system cost estimates for existing and alternative systems..

Chapter 5 details the net effects analysis process undertaken by the Cost discipline. The six alternative systems are measured and compared for the residential sector (on a region by region basis) and for the IC&I systems (on a GTA-wide basis) according to established criteria.

2.0 APPROACH

2.1 Overview

The GTA 3Rs Analysis developed a set of six possible residential and another six possible IC&I waste diversion systems (including the Existing and the Existing/Committed Systems). Each of these systems were analysed by several disciplines, in order to complete a comprehensive analysis of the possible alternatives. One of the perspectives taken was that of Cost. The analytical process undertaken by the Cost discipline is outlined in this section of the Technical Appendix for Cost. The costs of residential and IC&I waste management systems were estimated and analysed separately in this study.

2.2 Impact Assessment Criteria

Once the range of systems had been identified, the Cost discipline undertook its analysis of the systems. The rationale for the cost indicators chosen is presented in Table 2.1.

The six residential systems were analysed by one criterion by the Cost discipline. This is cost per household for the waste management system (diversion and disposal). Other diversion system cost indicators such as cost per household per year for diversion and cost per tonne diverted were also considered but were found to be of little value for the comparative evaluation process.

The six IC&I systems were analysed according to two criteria under the Cost discipline. These included cost per tonne diverted and total system cost (diversion plus disposal) in $ million/year. Each IC&I system was analysed on a GTA-wide basis.

2.3 Approach

A "unit cost" approach was used for estimating the comparative costs of different systems. In this approach, the number of tonnes of material managed by different methods (e.g. Blue Box Collection, yard waste composting, etc.) was multiplied by a unit cost per tonne, to estimate costs for that component. All component costs were then added to estimate system costs. The number of tonnes managed by each method was obtained from Chapter 4 (Residential) and Chapter 6 (IC&I) of the Service Technical Appendix. These tonnes were estimated using 1992 waste generation and composition data as a "base case" for comparative purposes.

While the approach has a number of limitations (in particular, it does not take into account economies of scale or cost efficiencies resulting from larger

Table 2.1

Alternative System Evaluation Criteria for Cost Residential and IC&I

Criteria Group/Criteria	Indicator	Definition	Rationale
Cost (Residential)			
Cost per Household (system)	• the cost of the waste management system including diversion ad disposal on a per household basis	the net cost of the waste management system diversion and disposal) after systemic revenue sources have been taken into account, divided by the number of households within the Region	Addresses the goal of minimizing cost
Cost (IC&I)			
Diversion System Cost	• the cost of the diversion system as expressed as cost per tonne diverted	The net cost of the diversion system divided by the number of tonnes diverted	Addresses the goal of minimizing cost
Total System Cost	• the cost of the total waste management system (disposal plus diversion)	The net cost of the waste management system (diversion and disposal)	Addresses the goal of minimizing cost

systems) it was considered at an adequate level of detail for the comparative ranking of systems for the Cost discipline.

2.4 Data Sources

All systems analysis is based on the best available information. The study team contacted representatives of each region and municipality in GTA to gather information related to costs of the Existing and Existing/Committed Residential waste diversion systems. Other waste diversion programs were also either contacted or studied to obtain information related to component and system costs. For instance, data related to capital and (unit) operating costs of various components of existing wet/dry and mixed waste processing systems (e.g. processing facilities, collection systems, bins, trucks etc.) were collected through a review of the literature, and telephone contact with staff in a number of jurisdictions.

Data for projected costs of IC&I systems was much more difficult to obtain. Many IC&I establishments contract privately for waste and recyclables collection and due to the competitive nature of the business, haulers were reluctant to share this information with the study team. Based on several assumptions and on the material diversion estimates presented in the Technical Appendix for service, unit costs of recycling and disposal were estimated per material for the IC&I sector for the Existing and Existing/Committed Systems. These same unit costs were then applied to the four other IC&I systems evaluated.

2.5 Assumptions

All cost estimates were based on 1992 Canadian $, and assume that the unit costs per tonne for various management options will remain at a similar level, regardless of the number of tonnes to be managed. While this is a limitation of the approach used, in that it does not take economies of scale into account, it was considered to be at an adequate level of detail for the GTA 3Rs analysis for the Cost discipline.

2.6 Methods of Analysis

Each of six residential and six IC&I potential waste diversion systems were studied in a "Net Effects Analysis" process. This involved a systematic analysis of each system according to the criteria outlined above. Residential systems were analysed on a region by region basis while the IC&I systems were analysed at the GTA-wide level. A technical ranking, from highest to lowest, was provided for each system, for each region for the residential systems (and for the GTA as a whole for the IC&I systems).

3.0 RESIDENTIAL SYSTEM COST ESTIMATES

3.1 General

The costs of Residential and IC&I waste management systems were estimated separately for this study. The costs for the IC&I systems were estimated for the entire GTA based on aggregated waste generation estimates for each region in the GTA and diversion estimates for the entire GTA region. Costs of residential systems were developed separately for each region, using unit costs for various operations (Blue Box collection, processing, leaf and yard waste collection and processing, etc.) experienced in each region in 1992.

This chapter presents the estimated costs for six residential systems for the regions of Durham, Metro, York and Peel and two residential systems (Existing and Existing/Committed) for Halton. These systems were presented and discussed in the Service Technical Appendix. It also presents the basis for these estimates. The six residential systems are as follows:

System 1 - Existing
System 2 - Existing/Committed
System 3 - Direct Cost
System 4 - Expanded Blue Box
System 5 - Wet/Dry
System 6 - Mixed Waste Processing

Section 3.2 of this chapter describes the approach to estimating the cost of these systems. Sections 3.3 to 3.7 summarize the estimated costs for the systems by Region.

3.2 Methodology Used

Capital and operating costs were developed separately for each residential system for each Region. The capital costs were supplied to Future Urban Research for use in the municipal finance evaluation of systems, but were not used directly in the comparative evaluation of systems for the cost discipline. Operating costs were developed to include a capital allowance for each system component. In this way, systems could be compared directly using the operating cost data, which took all factors into account.

Each section of this chapter will present two sets of cost data, referred to as "original costs" and "updated costs". The "original costs" were developed in May 1993, and were used in the municipal finance evaluation (Future Urban Research, 1993) carried out as part of the GTA 3Rs analysis. The original unit costs were developed using information available in May 1993, and were

based on diversion estimates completed at that time, showing the number of tonnes of material handled by each management method.

Informal meetings were held with regional waste reduction staff in late June 1993 to obtain feedback on the unit rates used for the analysis. Additional potential sources of regional cost information were identified at these meetings and were contacted in June-July 1993. In addition, some of the preliminary waste diversion estimates were updated, which altered the number of tonnes managed by different methods. An updated set of costs were developed, but it was too late in the study schedule to revise the municipal finance assessment with the new cost data, therefore the assessment was based on the original cost data. The updated cost data will be incorporated into future revisions of both the municipal finance and cost discipline assessments.

The analysis assumed that all waste management activities in GTA Regions would continue to operate at current cost levels, which differ from one Region to another for a number of reasons. Future assessments may consider the possibility that unit rates in all GTA Regions may be similar in the future, due to efficiencies in system design and operation, economics realized when greater quantities of material are managed, etc. The cost estimates used therefore overestimate the likely cost of systems.

To provide a common basis of comparison, the total system and diversion system costs (in $ million/year) were divided by the total number of households in each Region (single family, multi-family and other) to estimate the $/household costs presented in this section. This calculation does not take into account the fact that different types of households (e.g. rural, multi-family) receive different levels of service. This approach was used because of the difficulty in reconciling information received from different sources on the actual number of households receiving different levels of service. In addition, all cost estimates were carried out for the high diversion scenario estimated for each system, i.e. assuming high diversion through backyard composters and high participation in all systems by multi-family unit residents.

The methods by which capital and operating costs were estimated are discussed separately below.

3.2.1 Capital Costs

The facilities required for each residential system were identified for each region. Capital costs for new facilities required for each system were developed assuming that one facility (such as a central composting facility or mixed waste plant) would handle all of the regional waste. The capacity of

these facilities was estimated using waste allocation data presented in the Service Technical Appendix. Regional budget estimates for capital expenditures on facilities such as composting facilities, etc. were used where available. Where regional budget estimates had not been developed for specific facilities (such as mixed waste processing plants), estimates were developed using typical cost-per-tonne-of-capacity data obtained from information on the constructed costs of similar facilities in Canada or the U.S.

Other capital cost items (such as trucks, household bins, etc.) were estimated using assumptions presented in Sections 3.3 to 3.6.

In all cases, cost data were converted to 1992 Canadian $. The unit costs used for each waste diversion operation included annualized costs for funding the capital costs of the system.

3.2.2 Operating Costs

Unit operating costs were developed for each method of waste management (Blue Box collection and processing, yard waste collection and processing, backyard composting, other waste diverted, garbage collection and disposal, wet/dry collection and processing, mixed waste processing). These unit costs covered a capital allowance for the elements of each processing method, in addition to the on-going operating expenses, to provide reasonably comprehensive cost information for comparing systems.

The unit cost rates for each region were developed as follows. Available cost data provided by the Regions were reviewed, and the number of tonnes handled by each processing and collection method were determined. Total costs were divided by the number of tonnes handled by each method (e.g. yard waste collection) to calculate a unit operating cost for that method in $/tonne. Estimates were run using 1992 cost data in all cases, and are presented in $ 1992 Canadian throughout the report. The number of tonnes managed by each method for each system were then estimated and multiplied by the unit costs to estimate system costs. These were divided by total households in each Region to estimate system costs per household. The costs developed by this method formed the basis of the comparative evaluation of systems in each region carried out by the cost discipline. Because the unit costs do not take economies of scale and future system efficiencies into consideration, this method overestimates system costs but provides a reasonable basis for comparative evaluation of systems.

It should be noted that overhead costs allocated to waste diversion in each region are not fully accounted for to date. MOEE funding of diversion systems was not considered in this analysis, as this funding is expected to disappear early in the planning period for this study.

Informal meetings were held with regional staff after preliminary cost estimates for the six residential systems had been developed. The preliminary results of the system cost estimates were discussed with Regional staff to establish if the unit costs used in the preliminary estimates were reasonable, and to identify additional sources of information which could be used. For some Regions, the unit costs were updated based on the results of these meetings, or on new data obtained from the contacts provided. Where there is a discrepancy between the data initially supplied to the municipal finance team and the later data, both sets of data are included in the Schedules contained at the end of this document.

The estimates will be further refined as the study progresses, but are reasonable for preliminary analysis and comparison of different systems. All cost estimates are considered to be of adequate accuracy for comparative evaluation of systems.

The cost estimating method used tries to take the unique features of each GTA region into account. It is assumed that the costs per tonne will remain the same, regardless of how many tonnes are managed by a particular method. This approach therefore does not take potential future system efficiencies and economies of scale into account.

3.3 Cost Estimates for Region of Durham

The capital and estimated unit operating costs of the six Durham residential systems are discussed below.

3.3.1 Capital Costs

Existing System Capital Costs

Capital costs for the existing system were not considered in this analysis, as it is in place at this time, and is assumed not to require additional capital expenditure.

Existing/Committed System Capital Costs

The 5 year funding commitments for Region of Durham are $3,875,500 (Future Urban Research, 1993), and include the following:

- $2,788,400 for MRF improvements
- $7,022,000 for changes to the MRF and depot operations
- $384,900 for backyard composting program

Direct Cost System Capital Costs and Revenues

Capital costs of the Durham Direct Cost system are assumed to be the same as for the Existing/Committed system. Revenues from the Direct Cost System were based on each single-family unit (approximately 102,000 units) and 40% of the "other" households (assumed to receive single-family service) using 100 garbage bags per household per year. This would result in a total of 102,000 + 0.4 x 33,913 = 116,000 households (approximately), using 11.6 million garbage bags. Revenues from the sale of bags/tags would therefore be somewhere between $2.9 and $11.6 million/year, depending on the charge per bag/tag. The higher figure assumes a charge of $1/bag, and the use of an average of 100 bags/tags/household/year. The lower figure assumes a charge of $0.25/bag at the same usage level. Multi-family households are not included in the Direct Cost estimates, as their waste is generally handled by private contractors. The range of 25¢ to $1 per bag/tag was used to illustrate the system sensitivity (in the municipal finance assessment) to the charge levied. These values are in line with the range of $0.30 to $1.35/lift cost calculated by Proctor & Redfern for the Town of Cobourg (Proctor & Redfern, 1993) and by RIS for Toronto (RIS, 1990).

Revenues from the Direct Cost system were not included in the cost analysis carried out by RIS.

Expanded Blue Box System Capital Costs

The Existing/Committed system in Durham may be able to handle the additional materials generated by an Expanded Blue Box system after the MRF improvements have been made. Otherwise, the Region would have to incur a cost of approximately $9 million for a new MRF. Centre and South Hastings were able to implement Expanded Blue Box without extensive changes to the existing MRF. On this basis, capital costs of the Expanded Blue Box system would vary from $3,875,500 with the existing MRF, to $9,000,000 with a new MRF.

Wet/Dry System Capital Costs

This system would require significant capital costs, including:

- $9 million for a new MRF (significantly less if the existing MRF could be expanded)
- $8.3 million for 55 new trucks
- $11 million to provide roll-out carts to 110,000 households
- $25 million approx. for a new central in-vessel composting facility with a capacity of 50,000 tonnes/year.

Total $50.6 million with new MRF

Mixed Waste Processing System Capital Costs

The Mixed Waste Processing system would add a facility to process the residential mixed waste that remains after source separation in the existing Blue Box, leaf and yard waste and backyard composting programs. This remaining waste is currently disposed as garbage. The Mixed Waste Processing system is an add-on to the Existing/Committed system, therefore the same tonnages were allocated to the Blue Box, yard waste and other waste (such as depots) as for the Existing/Committed system. The tonnage remaining would be sent to mixed solid waste (MSW) processing.

This system would require an estimated $50 million capital expenditure for a mixed waste plant with a capacity of 112,000 tonnes/year. The capital cost of a 430 tonne/day plant is based on capital costs reported for St. Cloud, Lakeside, Newcastle, Portage, Ferndale, and Portland MSW plants (see Schedule G, Service Appendix for details). These averaged $81,000 US/tpd capacity, which converts to $116,000 Can/tpd ($81,000US x 1.3 (Can) x 1.1 tonnes from tons). On the basis that a 430 tonne/day plant would be required in Durham, the capital costs would be $116,000 x 430 = $49,980,000, or approximately $50 million Canadian. This capital cost was amortized over a 15 year period, using an interest rate of 10%, yielding a capital cost allowance of $58/tonne. This was "rounded up" to $73/tonne to give a total (capital plus operating) cost of $150/tonne with operating costs estimated at $77/tonne (see operating cost description). The updated costs used the actual estimated capital cost of $58/tonne.

The system costs would therefore be:

- $3,875,500 as with Existing/Committed, and
- $50,000,000 for the mixed waste plant.

Total $53,875,500.

3.3.2 Original Unit Operating Costs

The costs presented in the Draft EA Input Document are based on preliminary unit cost rates developed using data available to RIS at the time the original work was carried out (May-June 1993). These have since been updated and will be presented in the Final EA Input Document. The basis of the original estimates is described in this section. The basis of the cost revisions is presented in Section 3.3.4. Because the municipal finance assessment was

carried out based on the original costs, the basis of both sets of data are presented.

Blue Box Collection and Processing

Blue Box collection costs of $92/tonne were based on Durham's current cost of $1,767,000 to collect 19,243 tonnes (including Igloos) in 1992. Of this total, 17,166 tonnes were collected curbside and the remainder (2077 tonnes) were collected in various depots. Some IC&I materials were delivered directly to the MRF, but it was assumed that these were delivered at zero collection cost.

Blue Box processing costs were estimated using the 1992 Durham Region labour estimate of $1,728,000, and the equipment lease cost of $450,000 divided by the estimated 21,000 tonnes of material processed at the MRF to calculate a cost of $104/tonne, which was rounded up to $110/tonne for preliminary estimates. The 21,000 tonnes of material processed at the MRF included 17,166 tonnes collected curbside, 2,077 tonnes collected in depots, and 1,757 tonnes assumed to be delivered directly to the MRF by IC&I sources.

Blue Box revenues were based on average Durham revenues for 1992, which were reported at $468,100 for sale of materials. This was divided by 21,000 tonnes of materials processed at the MRF, which gives estimated average revenues of $22/tonne.

Yard Waste

Yard waste collection costs were taken from an AMRC report and were based on the $74/tonne collection cost reported by Etobicoke for collection of bagged leaf and yard waste. (ORTECH International, 1993).

Yard waste processing costs were taken from the AMRC report referenced above and were based on an allowance of $33/tonne for operation of an open windrow site, and $22/tonne for capital costs (for Waterloo, Ontario).

No revenues were included for compost sales, in part as these were expected to be low, and also because assuming zero revenue provides a conservatively higher cost estimate.

Backyard Composting

Backyard composting costs of $25/tonne were used to account for the capital and operating costs of running backyard composting programs. The costs were based on estimates by Compost Management Associates (Compost Management Associates, 1992) of approximately $23/tonne for Region of Durham, increased by approximately 10% to allow for some contingency costs,

such as additional promotion/education expenses and also "round up" the value to $25/tonne.

Other Waste Diverted

Other waste diverted includes miscellaneous materials collected at depots and transfer stations, such as wood and brush, leaves and yard waste, scrap metal, OCC, ONP, drywall, tires, waste oil, batteries, propane tanks, paint products and clean fill. An estimate of $100/tonne was used to reflect the handling costs for these materials.

Garbage Collection and Disposal

Garbage collection costs of $60/tonne were used, based on Metro Toronto costs (Metropolitan Toronto Commissioner of Works, 1992).

Garbage disposal costs were based on a $90/tonne unit rate which was being negotiated between Durham and Metro (information from Future Urban Research). Because Brock West landfill is located in Pickering, the Region of Durham was permitted to dispose of a certain quantity of material at no charge. In 1992, Durham were charged $150/tonne, but received a rebate of $70/tonne, resulting in net disposal costs of $80/tonne. A sensitivity of the system costs to disposal costs was run, using $40/tonne for disposal. This lower rate was based on typical costs for larger landfills (VHB Research and Consulting, Inc. 1993). The value of $80/tonne was considered the price of disposal whereas $40/tonne is the cost of disposal. This is based on a payment of approximately $15.4 million to Metro by Durham, and a rebate of approximately $11.7 million resulting in a net cost of $3.61 million for disposal of approximately 104,571 tonnes (approximately $351 tonne). Subsequent discussions with Region of Durham staff (Egli, P, 1993) indicated that the actual 1992 cost was approximately $35/tonne.

Wet/Dry Collection and Processing Costs

No full scale wet/dry system cost data were available for use in the analysis, hence estimates from a number of sources were consulted.

Two-stream collection costs estimated by City of Guelph were reviewed (Cave, R. 1992). It was estimated that it would cost $3,525,000 per year to collect an estimated 142,000 tonnes of waste by the wet/dry in the year 2003. This translates to an estimated unit cost of approximately $25/tonne. This was considerably lower than other costs identified, and is also lower than current garbage collection costs of $40-60/tonne, therefore it was not used in the analysis.

RIS carried out preliminary estimates of the collection costs for a three-stream system for Region of Durham single-family households (105,000 approx.), using an in-house recycling system design model. These were estimated at $60/tonne for collection. A $15/tonne allowance was added to the collection cost to account for the capitalization of the purchase costs for 1 large bin for each single-family household (at $100/bin), which was an overestimate, but was included in the preliminary cost assessment as a contingency figure. A three stream wet/dry collection cost of $75/tonne was therefore used.

Processing costs for dry materials collected by the three-stream Wet/Dry system were assumed to remain at $110/tonne, as with the current Blue Box system. There would likely be some efficiencies in processing of the larger quantities of dry materials collected in the three stream Wet/Dry system, in a new state-of-the-art MRF, but these were not taken into account in this analysis.

Wet processing costs are based on the rate of $40 to 60/tonne reported for the Hensall Composting Facility in Ontario, without preprocessing (Jacob, Hensall Composting Facility 1993). A rate of $55/tonne was chosen, to be at the high end of the range.

Unit Operating Costs For Mixed Solid Waste Processing

MSW processing costs of $150/tonne used for the preliminary analysis were made up of $77/tonne for operating costs, and $73/tonne for capital costs.

Operating costs for MSW plants were estimated using data from the St. Cloud, Truman, Portage and Portland plants (see Schedule G, Service Appendix). These averaged $54 US/tonne, which converts to $77 Canadian/tonne.

3.3.3 Original Estimated System Costs

The original unit operating costs, and the tonnages diverted by each processing method are shown in Table 3.1. A summary of the diversion, disposal and total system costs for each of the six residential systems, based on the original unit operating costs, is shown in Table 3.2. This table also shows the annual diversion system cost on a $ per household and $ per tonne basis, and the total system cost on a $ per household basis. The total number of 147,105 households in Region of Durham in 1992 (single family, multi-family and other) was used for the per household cost calculations.

The total annual system cost was estimated at $20.6 million and $20.4 million for the Existing and Existing/Committed systems respectively, based on a disposal rate of $90/tonne (which was the rate being discussed by Metro and Durham when the estimates were originally developed). The total system

Table 3.1

Original Unit Costs and Cost Estimates, Region of Durham

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Blue Box Net	Yard Waste Collection	Yard Waste Processing	Yard Waste Net	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection
Unit Cost	($/t)	$92	$110	$22	$180	$74	$55	$129	$25	$100	$60	$90	$150	$75
Existing	tonnes	19,857	19,857	19,857	19,857	8,045	8,045	8,045	5,388	3,451	103,091	103,091		
	cost ($)	$1,826,844	$2,184,270	$436,854	$3,574,260	$595,330	$442,475	$1,037,805	$134,700	$345,100	$6,185,460	$9,278,190		
Existing/ Committed	tonnes	19,857	19,857	19,857	19,857	8,045	8,045	8,045	6,348	3,451	102,131	102,131		
	cost($)	$1,826,844	$2,184,270	$436,854	$3,574,260	$595,330	$442,475	$1,037,805	$158,700	$345,100	$6,127,860	$9,191,790		
Direct Cost	tonnes	32,124	32,124	32,124	32,124	12,269	12,269	12,269	19,502	3,451	74,326	74,326		
	cost ($)	$2,955,408	$3,533,640	$706,728	$5,782,320	$907,906	$674,795	$1,582,701	$487,550	$345,100	$4,459,560	$6,689,340		
Expanded Blue Box	tonnes	44,075	44,075	44,075	44,075	8,045	8,045	8,045	19,502	3,451	66,598	66,598		
	cost ($)	$4,054,900	$4,848,250	$969,650	$7,933,500	$595,330	$442,475	$1,037,805	$487,550	$345,100	$3,995,880	$5,993,820		
Wet/Dry	tonnes		44,075	44,075			23,979	23,979	19,502	3,451		50,664		118,718
	cost ($)		$4,848,250	$969,650			$1,318,845	$3,093,291	$487,550	$345,100		$4,559,760		$8,903,850
Mixed Waste Processing	tonnes	19,857	19,857	19,857	19,857	8,045	8,045	8,045	19,502	3,451	88,977		88,977	
	cost ($)	$1,826,844	$2,184,270	$436,854	$3,574,260	$595,330	$442,475	$1,037,805	$487,550	$345,100	$5,338,620		$13,346,550	
- if compost landfilled	tonnes											45,000		
	cost ($)											$4,050,000		
- if compost marketed	tonnes											17,000		
	cost ($)											$1,530,000		

Notes:

1. See Service Technical Appendix for Derivation of tonnes managed by different system components
2. See Tables 3.3 and 3.4 for updated diversion estimates and costs

Summary of Original Residential System Costs
Region of Durham

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Costs	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	27	$2,422,174	$2,669,691	$5,091,865	$6,185,460	$9,278,190	$15,463,650	$20,555,515	$139	$35	$140
2	Existing/ Committed	28	$2,422,174	$2,693,691	$5,115,865	$6,127,860	$9,191,790	$15,319,650	$20,435,515	$136	$35	$139
3	Direct Cost	48	$3,863,314	$4,334,357	$8,197,671	$4,459,560	$6,689,340	$11,148,900	$19,346,571	$122	$56	$132
4	Expanded Blue Box	53	$4,650,230	$5,153,725	$9,803,955	$3,995,880	$5,993,820	$9,989,700	$19,793,655	$131	$67	$135
5	Wet/Dry	64	$5,104,050	$6,030,095	$11,134,145	$3,799,800	$4,559,760	$8,359,560	$19,493,705	$122	$76	$133
6	Mixed Waste Processing	69-92	$2,422,174	$3,022,541	$19,067,265	$5,338,620	$1,530,000 to $4,050,000	$6,868,620 to $9,388,620	$25,935,885 to $28,455,885	$155 $201	$130	$176 $193
		MSW Processing		$13,622,550								

Notes:

1. Refer to Table 3.1 for derivation of costs
2. Refer to Service Technical Appendix for derivation of diversion estimates
3. System costs divided by total number of 147,105 households (single family, multi-family, other) in Region of Durham in 1992
4. All costs are in 1992 $

costs per household were estimated at $140/hhld/year and $139/hhld/year for these systems respectively.

The Direct Cost, Expanded Blue Box and Wet/Dry systems had similar estimated annual costs at $19.3 million, $19.8 million, and $19.5 million respectively, based on a disposal rate of $90/tonne. The total system cost per household was estimated at $132/hhld/year, $133/hhld/year and $135/hhld/year for these three systems respectively. This result may appear surprising, considering the capital and operating costs of some of the systems considered. However, high diversion systems save on garbage collection (at $60/tonne) and garbage disposal (at $90/tonne) for a total savings of $150/tonne in garbage management costs in high diversion systems.

The total annual system cost of the Mixed Waste Processing system was estimated at $25.9 million if the compost was marketed, and $28.5 million if the compost was landfilled, based on a garbage disposal rate of $90/tonne. The total system cost per household was estimated at $176/hhld/year (compost marketed) and $193/hhld/year (compost landfilled).

The above costs were used in the municipal finance assessment, and in the comparative evaluation carried out by the cost discipline.

3.3.4 Updated Unit Operating Costs

A meeting was held with Region of Durham staff on June 11, 1993, to discuss preliminary study results based on the unit cost data presented in Section 3.3.2. Some of the unit rates originally used were updated as a result of information obtained at this meeting (Watson, 1993). The analysis presented in the Draft EA Input Document is based on the original costs. The Final EA Input Document will incorporate the updated costs, which are discussed below.

Blue Box Collection and Processing

Durham regional staff suggested that the Blue Box processing cost should be based on Durham's 1992 costs of $3.4 million to process 21,000 tonnes of materials, which gives a unit cost of $162/tonne (Watson, 1993). This replaces $110/tonne, which was used for preliminary calculations.

The updated Blue Box collection cost of $103/tonne is based on Durham's 1992 cost of $1,767,000 to collect 17,166 tonnes of dry recyclables curbside (excluding materials collected at Igloos) in 1992. This replaces the original value of $92/tonne, which included the materials collected at depots.

Updated Blue Box revenues of $26/tonne are based on average Durham revenues for 1992, which were confirmed by Regional staff at $543,000 for sale of materials. (Budget data had used a figure of $468,100). The updated figure was divided by 21,000 tonnes handled at the MRF, which gives average revenues of $26/tonne. This cost replaces $22/tonne which was used initially.

Yard Waste

Yard waste collection costs are based on information obtained from telephone conversations with staff at the Town of Whitby (Gale, 1993), and BFI, Oshawa (O'Leary, 1993), who handle yard waste collection of Newcastle and Ajax. The Town of Whitby reportedly spent $203,328 to collect approximately 2,400 tonnes of yard waste in 1992 (Gale, 1993), which yields a unit cost of $85/tonne. The average cost to collect yard waste for Newcastle & Ajax in 1992 estimated at $70/tonne. These costs were averaged to give a collection cost of $78/tonne for yard waste, which replaces $74/tonne used previously.

The 1992 contracted price for yard waste processing in Durham was confirmed at $88/tonne (Watson, 1993). This replaces an estimate of $55/tonne which was used in preliminary calculations. No revenues were included for compost sales.

Backyard Composting

The same backyard composting cost of $25/tonne was used as in the previous estimates.

Other Waste Diverted

An updated unit cost of $188/tonne was used for other waste diverted, based on a reported cost of $75,000 to handle 400 tonnes of materials at Oshawa Transfer Station in Durham in 1992 (Watson, 1993). This replaces the earlier estimate of $100/tonne.

Garbage Collection and Disposal

Updated garbage collection costs of $45/tonne were used, based on an average value for residential waste collection for Newcastle, Ajax and Pickering. (O'Leary, 1993).

Garbage disposal costs were confirmed at $34.60/tonne for 1992 (Egli, 1993). Estimates have been developed at this rate (rounded up to $35/tonne) and also at $90/tonne, assuming that garbage disposal costs may increase in the future.

Wet/Dry Operating Costs

The Town of Markham are proposing to pilot test a Wet/Dry system in 1994. They predict that the cost of collection for a 3-stream system will be approximately $130/tonne, including an allowance for purchase of bins. (LURA Group, 1992). Costs presented in the Draft EA Input Document are based on a collection cost $75/tonne. The range of $75-130/tonne is used for updated cost estimates.

Processing costs for dry materials in the three-stream Wet/Dry system were assumed to remain at the updated rate of $162/tonne(the updated Blue Box processing costs). This is considered an over estimate, and may be decreased at a future date.

Wet processing costs of $60/tonne, (based on data from the Hensall Compost Facility) will be used until more applicable cost data for a full-scale centralized in-vessel composting facility are available (The $60/tonne rate is considered low).

3.3.5 Updated System Costs

The updated unit operating costs and updated tonnages are presented in Table 3.3. Table 3.4 summarizes the updated costs for each system.

The updated annual system costs of the Existing and Existing/Committed systems are similar, at $21.1 million, and $21 million respectively, based on a disposal rate of $90/tonne. The total system cost per household is estimated at $144/hhld/year and $143/hhld/year, respectively, for the two systems.

The Direct Cost and Expanded Blue Box system costs are similar, at $20.4 million and $21.6 million respectively. The total system cost per household is estimated at $139/hhld/year and $147/hhld/year respectively for the two systems.

The total three stream wet/dry system cost is estimated at $28.2 million, based on a three stream wet/dry collection cost of $130/tonne, and a disposal rate of $90/tonne. The total system cost $21.9 million per year if wet/dry collection cost are $75/tonne, which is the lower end of the potential cost range considered in this study. The total system cost per household is estimated at $192/hhld/year for the higher wet/dry collection cost, and $149/hhld/year for the lower cost.

The total mixed waste processing system cost is estimated at $25.5 million (compost marketed), and $27.5 million (compost landfilled), based on the

Updated Blue Box revenues of $26/tonne are based on average Durham revenues for 1992, which were confirmed by Regional staff at $543,000 for sale of materials. (Budget data had used a figure of $468,100). The updated figure was divided by 21,000 tonnes handled at the MRF, which gives average revenues of $26/tonne. This cost replaces $22/tonne which was used initially.

Yard Waste

Yard waste collection costs are based on information obtained from telephone conversations with staff at the Town of Whitby (Gale, 1993), and BFI, Oshawa (O'Leary, 1993), who handle yard waste collection of Newcastle and Ajax. The Town of Whitby reportedly spent $203,328 to collect approximately 2,400 tonnes of yard waste in 1992 (Gale, 1993), which yields a unit cost of $85/tonne. The average cost to collect yard waste for Newcastle & Ajax in 1992 estimated at $70/tonne. These costs were averaged to give a collection cost of $78/tonne for yard waste, which replaces $74/tonne used previously.

The 1992 contracted price for yard waste processing in Durham was confirmed at $88/tonne (Watson, 1993). This replaces an estimate of $55/tonne which was used in preliminary calculations. No revenues were included for compost sales.

Backyard Composting

The same backyard composting cost of $25/tonne was used as in the previous estimates.

Other Waste Diverted

An updated unit cost of $188/tonne was used for other waste diverted, based on a reported cost of $75,000 to handle 400 tonnes of materials at Oshawa Transfer Station in Durham in 1992 (Watson, 1993). This replaces the earlier estimate of $100/tonne.

Garbage Collection and Disposal

Updated garbage collection costs of $45/tonne were used, based on an average value for residential waste collection for Newcastle, Ajax and Pickering. (O'Leary, 1993).

Garbage disposal costs were confirmed at $34.60/tonne for 1992 (Egli, 1993). Estimates have been developed at this rate (rounded up to $35/tonne) and also at $90/tonne, assuming that garbage disposal costs may increase in the future.

Wet/Dry Operating Costs

The Town of Markham are proposing to pilot test a Wet/Dry system in 1994. They predict that the cost of collection for a 3-stream system will be approximately $130/tonne, including an allowance for purchase of bins. (LURA Group, 1992). Costs presented in the Draft EA Input Document are based on a collection cost $75/tonne. The range of $75-130/tonne is used for updated cost estimates.

Processing costs for dry materials in the three-stream Wet/Dry system were assumed to remain at the updated rate of $162/tonne(the updated Blue Box processing costs). This is considered an over estimate, and may be decreased at a future date.

Wet processing costs of $60/tonne, (based on data from the Hensall Compost Facility) will be used until more applicable cost data for a full-scale centralized in-vessel composting facility are available (The $60/tonne rate is considered low).

3.3.5 Updated System Costs

The updated unit operating costs and updated tonnages are presented in Table 3.3. Table 3.4 summarizes the updated costs for each system.

The updated annual system costs of the Existing and Existing/Committed systems are similar, at $21.1 million, and $21 million respectively, based on a disposal rate of $90/tonne. The total system cost per household is estimated at $144/hhld/year and $143/hhld/year, respectively, for the two systems.

The Direct Cost and Expanded Blue Box system costs are similar, at $20.4 million and $21.6 million respectively. The total system cost per household is estimated at $139/hhld/year and $147/hhld/year respectively for the two systems.

The total three stream wet/dry system cost is estimated at $28.2 million, based on a three stream wet/dry collection cost of $130/tonne, and a disposal rate of $90/tonne. The total system cost $21.9 million per year if wet/dry collection cost are $75/tonne, which is the lower end of the potential cost range considered in this study. The total system cost per household is estimated at $192/hhld/year for the higher wet/dry collection cost, and $149/hhld/year for the lower cost.

The total mixed waste processing system cost is estimated at $25.5 million (compost marketed), and $27.5 million (compost landfilled), based on the

Region of Durham

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	Backyard Composting Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	High Wet/Dry Collection	Low Wet/Dry Collection	Wet Composting
Unit Cost	($/t)	$103	$162	$26	$78	$88	$25	$188	$45	$90	$135	$130	$75	$60
Existing	tonnes	19,857	19,857	19,857	8,045	8,045	5,388	5,291	103,091	103,091				
	cost ($)	$2,045,271	$3,216,834	$516,282	$627,510	$707,960	$134,700	$994,708	$4,639,095	$9,278,190				
Existing/ Committed	tonnes	19,857	19,857	19,857	8,045	8,045	6,348	5,291	102,131	102,131				
	cost($)	$2,045,271	$3,216,834	$516,282	$627,510	$707,960	$158,700	$994,708	$4,595,895	$9,191,790				
Direct Cost	tonnes	30,674	30,674	30,674	9,987	9,987	22,759	5,291	72,961	72,961				
	cost ($)	$3,159,422	$4,969,188	$797,524	$778,986	$878,856	$568,975	$994,708	$3,283,245	$6,566,490				
Expanded Blue Box	tonnes	42,788	42,788	42,788	8,045	8,045	22,759	5,291	62,794	62,794				
	cost ($)	$4,407,164	$6,931,656	$1,112,488	$627,510	$707,960	$568,975	$994,708	$2,825,730	$5,651,460				
Wet/Dry	tonnes		42,788	42,788		9,987	22,759	5,291		51,014		19,820	19,820	9,833
	cost ($)		$6,931,656	$1,112,488		$878,856	$568,975	$994,708		$4,591,260		$2,576,600	$1,486,500	$589,980
Mixed Waste Processing	tonnes	19,857	19,857	31,353	8,045	8,045	22,759	5,291	85,721		85,721			
	cost ($)	$2,045,271	$3,216,834	$815,167	$627,510	$707,960	$568,975	$994,708	$3,857,445		$11,572,335			
- compost landfilled	tonnes									52,315				
	cost ($)									$4,708,363				
- compost marketed	tonnes									30,405				
	cost ($)									$2,736,460				

Notes:

- Blue Box collection costs based on 1992 costs $1,767,000 to collect 17,166 tonnes (excluding Igloos) (Watson, Region of Durham, 1993)
- Blue Box Processing cost based on 1992 cost of $3.4 million to process 21,000 tonnes (Watson, Region of Durham, 1993)
- Blue Box Revenue based on $543,000 for sale of 21,000 tonnes of materials at the Durham MRF in 1992 (Watson, Region of Durham, 1993)
- Yard Waste collection cost based on average collection costs for Whitby, Newcastle and Ajax (Gale, Town of Whitby [date] (O'Leary, BFI Oshawa, 1993)
- Yard Waste processing based on 1992 contracted price of $88/tonne (Watson, Region of Durham1993)
- Other Waste Diverted cost based on $75,000/400 tonnes ($188/tonne - from Oshawa transfer station in Durham,1993)
- Garbage Collection cost based on average cost for Pickering, Ajax, and Newcastle (O'Leary, BFI Oshawa, 1993)
- Garbage Disposal cost based on Durham rate of $90/tonne currently being negotiated between Metro and Durham (Source: Future Urban Research, 1993). Low disposal rate is assumed for sensitivity.
- Wet Composting cost based on Hensall for in-vessel (Jacob, 1993)
- High Wet/Dry Collection cost based on Markham Wet/Dry study (including bins) - $130/tonne (LURA Group, 1993)
- Low Wet/Dry Collection cost is estimated to be $60/tonne, plus $15/tonne for purchase of bins, for a total of $75/tonne (RIS estimate)

ge Disposal @ $90/tonne
ard composter diversion @ 240 kg/yr

Summary of Updated Residential System Costs
Region of Durham

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost $/hhld
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	
1	Existing	27	$2,672,781	$4,537,920	$7,210,701	$4,639,095	$9,278,190	$13,917,285	$21,127,986	$187	$49	$144
2	Existing/ Committed	28	$2,672,781	$4,561,920	$7,234,701	$4,595,895	$9,191,790	$13,787,685	$21,022,386	$183	$49	$143
3	Direct Cost	48	$3,938,408	$6,614,203	$10,552,611	$3,283,245	$6,566,490	$9,849,735	$20,402,346	$154	$72	$139
4	Expanded Blue Box	56	$5,034,674	$8,090,811	$13,125,485	$2,825,730	$5,651,460	$8,477,190	$21,602,675	$166	$89	$147
5A	Wet/Dry (H)	64	$8,139,040	$8,851,687	$16,990,727	$6,631,820	$4,591,260	$11,223,080	$28,213,807	$187	$116	$192
5B	Wet/Dry (L)	64	$4,695,600	$8,851,687	$13,547,287	$3,826,050	$4,591,260	$8,417,310	$21,964,597	$149	$92	$149
6	Mixed Waste Processing	70-88	$2,672,781	$4,673,310	$18,918,426	$3,857,445	$4,708,363 to $2,736,460	$8,565,808 to $6,593,905	$27,484,234 to $25,512,331	$170 $212	$129	$187 $173
			MSW Processing	$11,572,335								

No. of Households = 147,105

Notes:
- (H) - Based on Wet/Dry Collection cost of $130/tonne
- (L) - Based on Wet/Dry Collection cost of $75/tonne
- Garbage Disposal at $90/tonne

updated unit operating costs, and a disposal rate of $90/tonne. The total system cost per household is estimated at $173/hhld/year (compost marketed) and $187/hhld/year (compost landfilled).

3.4 Cost Estimates for Metropolitan Toronto

The capital and estimated unit operating costs of the six Metro Toronto residential systems are discussed below.

3.4.1 Capital Costs

Existing System Capital Costs

Capital costs for the existing system were not considered in this analysis, as it is in place at this time, and is assumed not to require additional capital expenditure.

Existing/Committed System Capital Costs

The municipal finance analysis included the following costs for the Existing/Committed system (Future Urban Research, 1993):

- $34,310,000 for new Recycling Centre No 3. Discussions with Metro staff indicate that construction of this facility will likely not proceed.
- $22,420,000 for Recycling Centre No 2 (facility only). Discussions with Metro staff indicate that there are no firm plans to construct this facility.
- $69,697,000 for a new Regional central composting facility (unlikely to proceed within the five-year period)
- $4,281,000 for an engineered Recycling Depot. Construction of the depot depends on future TTC plans for the area.
- $1,158,000 for equipment at Commissioner St. MRF
- $507,000 for a Household Hazardous Waste Depot
- $180,000 for the pilot Wet/Dry program. It should be noted that the program is winding down.
- $1,576,000 for expanding recycling services to the remaining 35% of multi-family units not currently receiving recycling services.
- $1,728,000 for additional backyard composters
- $124,000 for additional roll-off containers for banned materials
- $147,000 for prototype vehicles
- $196,000 for tire recycling
- $1,449,000 for an additional recycling facility (unlikely to proceed)

Total $136,405,000

Direct Cost System Capital Costs and Revenues

Capital costs for the Direct Cost system are assumed to be the same as for the Existing/Committed system. Revenues were based on each single-family unit (approximately 288,000 units) and 40% of the "other" households (assumed to receive single family service) using 100 garbage bags per year. This would result in a total of 288,276 +0.4 x 269,504 = 396,078 households (approximately), using 39.6 million garbage bags. Revenues from the sale of bags/tags would therefore be somewhere between $10 and $40 million/year, depending on the charge per bag/tag. The higher figure assumes a charge of $1/bag, and the use of an average of 100 bags/tags/household/year. The lower figure assumes a charge of $0.25/bag with the same usage rate. Multi-family households are not included in the Direct Cost estimates, as their waste is generally handled by private contractors.

Revenues from the Direct Cost system were not included in the cost analysis, but were considered in the municipal finance impacts evaluated by the municipal finance team (Future Urban Research, 1993).

Total $136,405,000 (Existing/Committed)

Expanded Blue Box System Capital Costs

The Existing/Committed system in Metro will likely be able to handle Expanded Blue Box system, if the new MRF's are constructed. No additional capital expenditures are anticipated for the Expanded Blue Box system, therefore capital costs are the same as for the Existing/Committed system.

Total $136,405,000 (Existing/Committed)

Wet/Dry System Capital Costs

Most of the facilities required for the three stream Wet/Dry system are included in the Existing/Committed system, which already includes capital allowances for additional dry processing capacity in new MRFs, and a central composting facility. The additional expenses would be:

- $22.2 million for 148 new trucks
- $40 million to provide roll-out carts to 400,000 single-family and similar "other" households

Total $136,405,000 (Existing/Committed)
$62,200,000 additional capital costs

$198,605,000 total

The three stream Wet/Dry system would service all single-family households, and 40% of other households, which are assumed to be similar to single-family households. It was assumed that three stream Wet/Dry collection for multi-family units will be handled by the private sector, by providing extra bins for voluntary participation. The capital cost of a three stream Wet/Dry collection truck ranges from $150,000 to $200,000. (Markham will test a truck costing $200,000). The capital cost of a packer truck is $100,000 to $120,000, so that the replacement fleet will be more expensive in a three stream Wet/Dry system.

Mixed Waste Processing System Capital Costs

The mixed waste plant capacity required for Metro would be approximately 900,000 tonnes/year. Costs for the plant were calculated using the "6/10ths rule" to scale the costs estimated for Region of Durham. ($50 million, for a capacity of approximately 112,000 tonnes/year.) The Metro plant would require 9 times this capacity. Using the 6/10ths rule, the costs should be 9 to the power of 0.6 times (about 4 times) the Durham costs. The estimated cost of the Metro mixed waste plant is therefore $200 to $250 million.

Because of its size, this capacity may need to be broken into two plants. For the purposes of the original estimate, it was assumed that there would be one plant only, at a cost of $250 million. If this system were adopted, it would eliminate the need for construction of the central composting facility (estimated cost $69,697,000) included in the Existing/Committed system. The costs of this system would therefore be:

- $65,984,000 for Existing/Committed without new composting facility
- $200,000,000 to $250,000,000 for a mixed waste processing plant

Total $266,708,000 to $316,708,000

3.4.2 Original Unit Operating Costs

Blue Box Collection and Processing

Blue Box collection and processing costs were reported at $199/tonne in 1992, based on information received from Metro (Metro Works, 1992). The split between collection and processing was assumed to be $130/tonne for collection, and $69/tonne for processing for preliminary estimates. This allocates roughly 2/3 of the total cost to collection and 1/3 to processing.

Blue Box revenues were assumed to be $12/tonne, based on information received from Metro (Metro Works, 1992).

Yard Waste

Yard waste collection costs were taken from an AMRC report and were based on the $74/tonne collection cost reported by Etobicoke for collection of bagged leaf and yard waste. (ORTECH International, 1993).

Yard waste processing costs were taken from the same report and were based on an allowance of $33/tonne for operation of an open windrow site, and $22/tonne for capital costs (for Waterloo, Ontario).

No revenues were included for compost sales, in part as these were expected to be low, and also because assuming zero revenue provides a conservatively higher cost estimate.

Backyard Composting

Backyard composting costs of $25/tonne were used to account for the capital and operating costs of running backyard composting programs. The costs were based on Compost Management Associates estimates of approximately $23/tonne for Region of Durham (Compost Management Associates, 1992), increased by approximately 10% to allow for some contingency costs.

Other Waste Diverted

Other waste diverted would include miscellaneous materials collected at depots and transfer stations. These include wood and brush, leaves and yard waste, scrap metal, OCC, ONP, drywall, tires, waste oil, batteries, propane tanks, paint products and clean fill. An estimate of $100/tonne was used to reflect the collection and management costs for these materials, which would be expected to be lower than the costs for Blue Box materials.

Garbage Collection and Disposal

Garbage collection costs of $60/tonne were used, based on Metro Toronto costs. (Metropolitan Toronto Commissioner of Works 1992).

Garbage disposal costs of $37/tonne which includes transfer and landfill site operations and site property costs have been reported by Metro. (Metropolitan Toronto Commissioner of Works 1992). A disposal cost of $80/tonne was used for preliminary analysis, to reflect the likelihood that garbage disposal costs and prices will increase in the future. The tables for the lower disposal rate may be found in Schedule B.

Table 3.5

Original Unit Costs and Cost Estimates
Metropolitan Toronto

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection
Unit Cost	($/t)	$130	$69	$12	$74	$55	$25	$100	$60	$80	$150	$75
Existing	tonnes	106,145	106,145	106,145	71,062	71,062	25,200	6,225	868,613	868,613		
	cost ($)	$13,798,850	$7,324,005	$1,273,740	$5,258,588	$3,908,410	$630,000	$622,500	$52,116,780	$69,489,040		
Existing/ Committed	tonnes	116,536	116,536	116,536	74,800	74,800	29,400	6,114	850,395	850,395		
	cost($)	$15,149,680	$8,040,984	$1,398,432	$5,535,200	$4,114,000	$735,000	$611,400	$51,023,700	$68,031,600		
Direct Cost	tonnes	288,020	288,020	288,020	74,800	74,800	81,221	6,114	627,090	627,090		
	cost ($)	$37,442,600	$19,873,380	$3,456,240	$5,535,200	$4,114,000	$2,030,525	$611,400	$37,625,400	$50,167,200		
Expanded Blue Box	tonnes	355,806	355,806	355,806	74,800	74,800	81,221	6,114	559,303	559,303		
	cost ($)	$46,254,780	$24,550,614	$4,269,672	$5,535,200	$4,114,000	$2,030,525	$611,400	$33,558,180	$44,744,240		
Wet/Dry	tonnes		355,806	355,806		221,708	81,221	6,114		412,396		989,910
	cost ($)		$24,550,614	$4,269,672		$12,193,940	$2,030,525	$611,400		$32,991,680		$74,243,250
Mixed Waste Processing	tonnes	116,536	116,536	203,990	74,800	74,800	81,221	6,114	798,574		798,574	
	cost ($)	$15,149,680	$8,040,984	$2,447,880	$5,535,200	$4,114,000	$2,030,525	$611,400	$47,914,440		$119,786,100	
- compost landfilled	tonnes									150,095		
	cost ($)									$12,007,600		
- compost marketed	tonnes									386,881		
	cost ($)									$30,950,480		

Notes:
1. See Service Technical Appendix for derivation of tonnes managed by different system components
2. See Tables 3.7 and 3.8 for updated costs and diversion estimates

Table 3.6

Summary of Original Residential System Costs
Metropolitan Toronto

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	19	$19,057,438	$11,211,175	$30,268,613	$52,116,780	$69,489,040	$121,605,820	$151,874,433	$145	$35	$174
2	Existing/ Committed	21	$20,684,880	$12,102,952	$32,787,832	$51,023,700	$68,031,600	$119,055,300	$151,843,132	$145	$38	$174
3	Direct Cost	42	$42,977,800	$23,173,065	$66,150,865	$37,625,400	$50,167,200	$87,792,600	$153,943,465	$149	$76	$177
4	Expanded Blue Box	48	$51,789,980	$27,036,867	$78,826,847	$33,558,180	$44,744,240	$78,302,420	$157,129,267	$152	$90	$180
5	Wet/Dry	62	$43,313,550	$35,116,807	$78,430,357	$30,929,700	$32,991,680	$63,921,380	$142,351,737	$119	$90	$163
6	Mixed Waste Processing	64-86	$20,684,880	$12,349,029	$152,820,009	$47,914,440	$12,007,600 to $30,950,480	$59,922,040 to $78,864,920	$212,742,049 to $231,684,929	$165 $230	$175	$244 $266
			MSW Processing	$119,786,100								

Notes:

1 Refer to Table 3.5 for derivation of costs

2 Refer to Service Technical Appendix for derivation of diversion estimates

3 System costs divided by 872,162 households in Metro Toronto in 1992

Wet/Dry Collection and Processing Costs

Three stream Wet/dry collection costs of $75/tonne were based on RIS preliminary estimates of the collection costs for a three-stream system for Region of Durham single-family households. (See Section 3.3).

Processing costs for dry materials in the three stream Wet/Dry system were assumed to remain at $69/tonne, as with the Blue Box system. There may be some efficiencies with the Wet/Dry system, but these are not taken into account in this analysis.

Wet processing costs of $55/tonne, based on data from the Hensall Compost Facility were used (Jacob, M. 1993).

Unit Operating Costs For Mixed Solid Waste Processing

MSW processing costs of $150/tonne, made up of $77/tonne for operating costs, and $73/tonne for capital costs were used for the original Metro cost estimates. The rationale for this cost is discussed in Section 3.3 for Region of Durham.

Because the size of the Metro plant would be much larger, the capital cost/tonne (which was $73/tonne in the original Durham estimate) would be significantly less than the Durham value. This was addressed in the updated Metro costs (See Section 3.4.4).

3.4.3 Original Estimated System Costs

The original unit operating costs, and the original estimated tonnages diverted by each processing method are shown in Table 3.5. A summary of the diversion, disposal and total system costs for each of the six residential systems, based on the original unit operating costs, is shown in Table 3.6. This table also shows the diversion system cost on a $ per household and $ per tonne basis, and the total system cost on a $ per household basis. The costs were estimated based on 872,162 households (single family, multi-family and other) in Metro in 1992. All system costs were estimated using a disposal rate of $80/tonne. A sensitivity analysis was carried out at a disposal rate of $37/tonne (the actual cost to Metro) and is presented in Schedule B.

The estimated annual total system costs for the Existing and Existing/Committed systems are similar, at $151.9 million and $151.8 million respectively, based on a disposal rate of $80/tonne. The total system costs per household are estimated at $174/hhld/year for both systems.

The estimated annual total system cost for the Direct Cost system is $153.9 million, and $152 million for the Expanded Blue Box system, based on a disposal rate of $80/tonne. The total system costs per household are estimated at $177/hhld/year and $180/hhld/year for the two systems, respectively. Revenues from the Direct Cost system were not considered in the analysis carried out by the cost discipline, but are addressed in the municipal finance assessment (Future Urban Research, 1993).

The estimated annual total system cost of the three stream Wet/Dry system was estimated at $142.4 million, based on a disposal rate of $80/tonne. The total system cost per household was estimated at $163/hhld/year for the three stream Wet/Dry system.

The annual total system cost of the Mixed Waste Processing system was estimated at $212.7 million if the compost is marketed, and $231.7 million if the compost is landfilled, based on a garbage disposal rate of $80/tonne. The total system cost per household was estimated at $244/hhld/year (compost marketed) and $266/hhld/year (compost landfilled).

3.4.4 Updated Unit Operating Costs

A meeting was held with Metro Toronto staff on June 21, 1993, to discuss preliminary study results based on the unit cost data presented in Section 3.4.2 (Pollock, Michael, Nanda, 1993). Some of the unit rates originally used were updated as a result of information obtained at this meeting. The analysis presented in the Draft EA Input Document is based on the original costs. The Final EA Input Document will incorporate the updated costs, which are discussed below.

Blue Box Collection and Processing

The total Blue Box collection and processing cost of $199/tonne was confirmed by Metro staff, but the split was changed to $161/tonne for collection, and $38/tonne for processing. The Blue Box revenues of $12/tonne were confirmed.

Yard Waste Collection and Processing, Backyard Composting, Garbage Collection and Disposal

Metro staff confirmed that the unit rates used were reasonable.

Updated Unit Costs and Cost Estimates
Metropolitan Toronto

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection	Wet/Dry Collection	Wet Composting
Unit Cost	($/t)	$161	$38	$12	$74	$55	$25	$188	$60	$90	$114	$130	$75	$60
Existing	tonnes	106,145	106,145	106,145	71,062	71,062	25,200	6,225	868,613	868,613				
	cost ($)	$17,089,345	$4,033,510	$1,273,740	$5,258,588	$3,908,410	$630,000	$1,170,300	$52,116,780	$78,175,170				
Existing/ Committed	tonnes	120,036	120,036	120,036	74,800	74,800	29,400	6,114	846,895	846,895				
	cost($)	$19,325,796	$4,561,368	$1,440,432	$5,535,200	$4,114,000	$735,000	$1,149,432	$50,813,700	$76,220,550				
Direct Cost	tonnes	291,520	291,520	291,520	74,800	74,800	81,221	6,114	623,590	623,590				
	cost ($)	$46,934,720	$11,077,760	$3,498,240	$5,535,200	$4,114,000	$2,030,525	$1,149,432	$37,415,400	$56,123,100				
Expanded Blue Box	tonnes	355,806	355,806	355,806	74,800	74,800	81,221	6,114	559,303	559,303				
	cost ($)	$57,284,766	$13,520,628	$4,269,672	$5,535,200	$4,114,000	$2,030,525	$1,149,432	$33,558,180	$50,337,270				
Wet/Dry	tonnes		355,806	355,806		74,800	81,221	6,114		412,396		989,909	989,909	146,907
	cost ($)		$13,520,628	$4,269,672		$4,114,000	$2,030,525	$1,149,432		$37,115,640		$128,688,170	$74,243,175	$8,814,420
Mixed Waste Processing	tonnes	120,036	120,036	231,144	74,800	74,800	81,221	6,114	795,074		795,074			
	cost ($)	$19,325,796	$4,561,368	$2,773,724	$5,535,200	$4,114,000	$2,030,525	$1,149,432	$47,704,440		$90,638,436			
- compost landfilled	tonnes									482,412				
	cost ($)									$43,417,122				
- compost marketed	tonnes									280,859				
	cost ($)									$25,277,273				

Notes:

- Blue Box costs taken from unpublished 1992 Annual Report. Total Gross Cost of Blue Box program is $199/tonne, split $161/tonne collection, $38/tonne processing.
- Blue Box revenue is $12/tonne, taken from unpublished 1992 Annual Report.
- Yard Waste collection cost based on Etobicoke cost of $74/tonne for bagged leaf and yard waste (Ortech International, 1993).
- Yard Waste processing based on $22/tonne capital, $33/tonne operating (for Waterloo, Ontario; Ortech International, 1993)
- Other Waste Diverted cost based on $75,000/400 tonnes ($188/tonne - from Oshawa transfer station in Durham) (Watson, 1993)
- Garbage Collection cost taken from Metropolitan Toronto Commissioner of Works (1992)
- Garbage Disposal cost is assumed
- High Wet/Dry Collection cost based on Markham Wet/Dry study (including bins) - $130/tonne (LURA Group, 1992)
- Low Wet/Dry Collection cost is estimated to be $60/tonne, plus $15/tonne for purchase of bins, for a total of $75/tonne

Backyard composter diversion @ 240 kg/yr

Table 3.8
Summary of Updated Residential System Costs
Metropolitan Toronto

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	19	$22,347,933	$8,468,480	$30,816,413	$52,116,780	$78,175,170	$130,291,950	$161,108,363	$148	$35	$185
2	Existing/ Committed	21	$24,860,996	$9,119,368	$33,980,364	$50,813,700	$76,220,550	$127,034,250	$161,014,614	$148	$39	$185
3	Direct Cost	42	$52,469,920	$14,873,477	$67,343,397	$37,415,400	$56,123,100	$93,538,500	$160,881,897	$148	$77	$184
4	Expanded Blue Box	48	$62,819,966	$16,544,913	$79,364,879	$33,558,180	$50,337,270	$83,895,450	$163,260,329	$153	$91	$187
5A	Wet/Dry (H)	62	$75,076,690	$25,359,333	$100,436,023	$53,611,480	$37,115,640	$90,727,120	$191,163,143	$151	$115	$219
5B	Wet/Dry (L)	62	$43,313,475	$25,359,333	$68,672,808	$30,929,700	$37,115,640	$68,045,340	$136,718,148	$103	$79	$157
6	Mixed Waste Processing	64-86	$24,860,996	$9,081,601	$124,581,033	$47,704,440	$43,417,122 to $25,277,273	$91,121,562 to $72,981,713	$215,702,595 to $197,562,746	$156 $209	$143	$247 $227
			MSW Processing	$90,638,436								

No. of Households = 872,162

Notes:
- (H) - Based on Wet/Dry Collection cost of $130/tonne
- (L) - Based on Wet/Dry Collection cost of $75/tonne
- Garbage Disposal at $90/tonne

Other Waste Diverted

Metro staff considered the unit rate of $188/tonne reported by Durham staff (Watson, 1993) for management of other material to be reasonable. This replaces the earlier estimate of $100/tonne.

Wet Dry Collection and Processing Costs

Updated estimates were developed using a range of $75/tonne (RIS) and $130/tonne (Markham) for three stream collection. Updated dry processing costs of $38/tonne provided by Metro staff were used.

Wet waste processing costs of $60/tonne (high end of range reported for Hensall) will be used, until more applicable cost data are identified.

Mixed Waste Processing

Original estimates were based on a rate of $150/tonne for all Regions. Updated estimates for Metro were based on a capital allowance of $37/tonne for capital, based on $250 million for a plant of 900,000 tonne annual capacity. This converts to $59,000/tonne/day of capacity. Amortized over 15 years at 10%, this converts to $37/tonne. Assuming that operating costs remain at $77/tonne, the updated unit cost for mixed waste processing in Metro is $114/tonne. ($37/tonne capital plus $77/tonne operating).

3.4.5 Updated System Costs

The updated unit operating costs and updated tonnages are presented in Table 3.7. Table 3.8 is a summary of costs based on the updated unit operating costs (discussed above).

As shown in the table, the total annual system costs for the Existing and Existing/Committed systems are estimated at $161.1 million and $161 million, based on a disposal rate of $90/tonne. The total system cost per household is estimated at $185/hhld/year for each system.

The Direct Cost system annual cost is estimated at $160.8 million, and the cost for the Expanded Blue Box system is estimated at $163.3 million, based on the updated unit operating costs and a disposal rate of $90/tonne. The total system costs per household are estimated at $184/hhld/year and $187/hhld/year respectively.

The total annual three stream wet/dry system cost is estimated at $191.1 million, based on the updated unit operating costs, a wet/dry collection cost of $130/tonne, and a disposal rate of $90/tonne. The total system cost is

estimated at $136.7 million per year when the three stream wet/dry collection rate drops to $75/tonne. The total system cost per household was estimated at $219/hhld/year for the higher wet/dry collection cost, and $157/hhld/year for the lower cost.

The total annual mixed waste processing system cost is estimated at $197.6 million (compost marketed), and $215.7 million (compost landfilled), based on the updated unit operating costs, and a disposal rate of $80/tonne. The total system cost per household is estimated at $227/hhld/year (compost marketed) and $247/hhld/year (compost landfilled). In all cases, the higher disposal rate of $90/tonne is used to reflect the fact that disposal costs and prices will likely increase in the future. Costs developed using the lower rate are presented in Schedule B.

3.5 Cost Estimates for Region of York

The capital and estimated unit operating costs of the six York residential systems are discussed below.

3.5.1 Capital Costs

Existing System Capital Costs

Capital costs for the existing system were not considered in this analysis, as it is in place at this time, and is assumed not to require additional capital expenditure.

Existing/Committed System Capital Costs

The 5 year funding commitments for Region of York are (Future Urban Research, 1993):

- $2,224,000 for new MRF
- $561,100 for miscellaneous increased operating costs

Total $2,785,100

Direct Cost System Capital Costs and Revenues

Capital costs for the Direct Cost system are assumed to be the same as for the Existing/Committed system. The revenues for the Direct Cost system were based on each single-family unit (approximately 128,000 units) and 40% of the "other" households (assumed to receive single-family service) using 100 garbage bags per year. This would result in a total of 128,061 + 0.4 x 15,189 = 134,000 households (approximately), using 13.4 million garbage bags.

Revenues from the sale of bags/tags would therefore be somewhere between $3.4 and $13.4 million/year, depending on the charge per bag/tag. The higher figure assumes a charge of $1/bag, while the lower figure is based on a change of $.25/bag. Multi-family households are not included in the Direct Cost estimates, as their waste is generally handled by private contractors.

Revenues from the Direct Cost system were not included in the cost analysis, but were evaluated in the municipal finance analysis (Future Urban Research, 1993).

Total $2,785,100

Expanded Blue Box System Capital Costs

The Existing/Committed system in York should be able to handle the additional quantities of dry recyclables generated by an Expanded Blue Box system with the new MRF. Otherwise, the Region of York would have to incur a cost of $9 to $10 million for a new MRF.

Total $2,785,100 with Existing MRF
$10,000,000 with new MRF

Wet/Dry System Capital Costs

This system would require significant capital costs, including:

- $10 million for a new MRF (could be reduced significantly if the existing MRF could be expanded)
- $7.1 million for 47 new trucks
- $13 million to provide roll-out carts to 130,000 households
- $25 to $30 million approx. for a new central in-vessel composting facility with a capacity of 50,000 to 60,000 tonnes.

There is a private sector operator in Newmarket (Canada Composting Inc.) who may provide wet waste processing capacity, thus avoiding the need to expend $25 to $30 million on a centralized composting plant. Costs are provided for both scenarios:

Total $60.1 million with new MRF and composting plant
$30 million if composting plant not required
$20 million if proposed MRF adequate.

Mixed Waste Processing System Capital Costs

The Mixed Waste Processing system would add a facility to process the residential mixed waste that remains after source separation in the existing Blue Box, leaf and yard waste and backyard composting programs. This remaining waste is currently disposed as garbage. The Mixed Waste Processing system is an add-on to the Existing/Committed system, therefore the same tonnages were allocated to the Blue Box, yard waste and other waste diversion methods as for the Existing/Committed system. The tonnage remaining, that would normally go to disposal in the other systems, would go to mixed solid waste (MSW) processing.

This system would require an estimated $55 million capital expenditure for a mixed waste plant with a capacity of 125,000 tonnes/year. The system costs would therefore be:

- $ 2,785,100 as with Existing/Committed, and
- $55,000,000 for the mixed waste plant.

Total $57,785,100.

3.5.2 Original Unit Operating Costs

The costs presented in the Draft EA Input Document were based on preliminary unit cost data available at the time the original work was developed. These have since been updated. The updates for Region of York will be presented in the Final EA Input Document. The basis of the original estimates is described in this section. The basis of the cost updates is presented in Section 3.5.4.

Blue Box Collection and Processing

All of the original Blue Box costs were based on data obtained form the Richmond Hill MRF (Commidge. R, 1993)

- The Blue Box collection cost of $76/tonne was based on Richmond Hill's 1992 cost of $319,000 to collect approximately 4,200 tonnes of recyclables.

- The Blue Box processing cost was based on Richmond Hill's cost of $261,300 to process 4,200 tonnes in 1992 (including truck rental). A capital cost of $25/tonne was assumed by RIS, and added to give $87/tonne for processing.

- Blue Box revenues of $33/tonne were based on reported revenues of $140,500 for 4,200 tonnes of material for Richmond Hill in 1992.

Yard Waste

Yard waste collection costs were based on $130,000 to collect approximately 1,970 tonnes of yard waste in Richmond Hill in 1992 (Commidge, R, 1993).

Yard waste processing costs were based on $35/tonne for Richmond Hill.

No revenues were included for compost sales, in part as these were expected to be low, and also because assuming zero revenue provides a conservatively higher cost estimate.

Backyard Composting

Backyard composting costs of $25/tonne were used to account for the capital and operating costs of running backyard composting programs. The costs were based on Compost Management Associates estimates of approximately $23/tonne for Region of Durham (Compost Management Associates, 1992), increased by approximately 10% to allow for some contingency costs.

Other Waste Diverted

Other waste diverted includes miscellaneous materials collected at depots and transfer stations, such as wood and brush, leaves and yard waste, scrap metal, OCC, ONP, drywall, tires, waste oil, batteries, propane tanks, paint products and clean fill. A unit cost of $188/tonne was used for other waste diverted, based on a reported cost of $75,000 to handle 400 tonnes of materials at Oshawa Transfer Station in Durham in 1992 (Watson, 1993).

Garbage Collection and Disposal

Garbage collection costs of $60/tonne were used, based on data for Newmarket for 1992 ($17.95 per capita times 45,500 people divided by 13,900 tonnes = $60/tonne).

Garbage disposal costs were assumed to be $80/tonne based on the fact that most Region of York waste is disposed in Metro landfills. A sensitivity of the system costs to disposal costs was run, using $40/tonne for disposal. This lower rate was based on typical costs for larger landfills (VHB Research and Consulting, Inc. 1993). The tables for the lower disposal rate may be found in Schedule C.

Wet/Dry Collection and Processing Costs

The Town of Markham is proposing to pilot test a Wet/Dry system. The town predicts that the cost of collection for a 3-stream system will be approximately $130/tonne, including bins. This higher collection cost was used for the Region of York three stream system cost estimates. A sensitivity analysis was run with the collection cost at $75/tonne, which included $60/tonne for collection, and $15/tonne for bins (see Section 3.3.2).

Processing costs for dry materials in the Wet/Dry system were assumed to remain at $87/tonne, as with the Blue Box system. There may be some efficiencies with the Wet/Dry system, but these are not taken into account in this analysis.

Wet processing costs were assumed to be $35/tonne, as these had originally been estimated along with yard waste processing costs. These costs are considered an underestimate (based on data subsequently received from the Hensall facility) and were increased in later estimates.

Unit Operating Costs For Mixed Solid Waste Processing

MSW processing costs of $150/tonne were used for the original Region of York estimates (See Section 3.3.1 for rationale).

3.5.3 Original Estimated System Costs

The original unit operating costs, and the tonnages diverted by each processing method are shown in Table 3.9. A summary of the diversion, disposal and total system costs for each of the six residential systems, based on the original unit operating costs, is shown in Table 3.10. This table also shows the diversion system cost on a $ per household and $ per tonne basis, and the total system cost on a $ per household basis. The total number of households in Region of York in 1992 (161,556) were used for the per household estimates.

The total annual system cost was estimated at $26.4 million for the Existing and Existing/Committed systems, based on a disposal rate of $80/tonne. The total system cost per household was estimated at $163/hhld/year for both systems.

The Direct Cost and Expanded Blue Box systems have similar estimated annual costs, at $23.9 million and $23.8 million respectively, based on a disposal rate of $80/tonne. The total system costs per household were estimated at $148/hhld/year and $147/hhld/year for both systems.

Table 3.9

Original Unit Costs and Cost Estimates
Region of York

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection
Unit Cost	($/t)	$76	$87	$33	$66	$35	$25	$188	$60	$80	$150	$130
Existing	tonnes	26,805	26,805	26,805	16,300	16,300	6,972	6,087	142,150	142,150		
	cost ($)	$2,037,180	$2,332,035	$884,565	$1,075,800	$570,500	$174,300	$1,144,356	$8,529,000	$11,372,000		
Existing/ Committed	tonnes	26,805	26,805	26,805	16,300	16,300	6,972	6,087	142,150	142,150		
	cost($)	$2,037,180	$2,332,035	$884,565	$1,075,800	$570,500	$174,300	$1,144,356	$8,529,000	$11,372,000		
User Pay	tonnes	50,965	50,965	50,965	16,300	16,300	26,046	6,087	98,917	98,917		
	cost ($)	$3,873,340	$4,433,955	$1,681,845	$1,075,800	$570,500	$651,150	$1,144,356	$5,935,020	$7,913,360		
Expanded Blue Box	tonnes	62,893	62,893	62,893	16,300	16,300	26,046	6,087	86,988	86,988		
	cost ($)	$4,779,868	$5,471,691	$2,075,469	$1,075,800	$570,500	$651,150	$1,144,356	$5,219,280	$6,959,040		
Wet/Dry	tonnes		62,893	62,893		34,225	26,046	6,087		69,063		166,181
	cost ($)		$5,471,691	$2,075,469		$1,197,875	$651,150	$1,144,356		$5,525,040		$21,603,530
Mixed Waste Processing	tonnes	26,805	26,805	41,131	16,300	16,300	26,046	6,087	123,076		123,076	
	cost ($)	$2,037,180	$2,332,035	$1,357,307	$1,075,800	$570,500	$651,150	$1,144,356	$7,384,560		$18,461,400	
- compost landfilled	tonnes									21,229		
	cost ($)									$1,698,320		
- compost marketed	tonnes									57,827		
	cost ($)									$4,626,160		

Notes:

- Blue Box Collection cost based on $319.011/4196 tonnes ($76/tonne) for Richmond Hill, 1992
- Blue Box processing cost based on $261259/4196 tonnes ($62/t - processing + truck rental) for Richmond Hill. A capital cost of $25/tonne is assumed and added to give
- Yard Waste collection cost based on $129,933/1967 tonnes ($66/tonne) for Richmond Hill, 1992
- Yard Waste processing cost based on $35/tonne for Richmond Hill
- Other Waste Diverted cost based on $75,000/400 tonnes ($188/tonne - from Oshawa transfer station in Durham) (Watson, 1993)
- Garbage Collection cost based on $17.95/capita*45,500 people(1991 census)/13,933 tonnes ($60/tonne - from Newmarket, 1992)
- Garbage Disposal cost is assumed at $80/tonne (same assumption as for Metro Toronto)
- Wet/Dry Collection cost based on Markham Wet/Dry study ($130/tonne - including bins) (LURA Group, 1992)
- See Service Technical Appendix for derivation of diversion estimates
- See tables 3.11 and 3.12 for updated diversion estimates and system costs

Table 3.10
Summary of Original Residential System Costs
Region of York

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	26	$3,112,980	$3,336,626	$6,449,606	$8,529,000	$11,372,000	$19,901,000	$26,350,606	$115	$40	$163
2	Existing/ Committed	28	$3,112,980	$3,336,626	$6,449,606	$8,529,000	$11,372,000	$19,901,000	$26,350,606	$115	$40	$163
3	User Pay	50	$4,949,140	$5,118,116	$10,067,256	$5,935,020	$7,913,360	$13,848,380	$23,915,636	$101	$62	$148
4	Expanded Blue Box	56	$5,855,668	$5,762,228	$11,617,896	$5,219,280	$6,959,040	$12,178,320	$23,796,216	$104	$72	$147
5	Wet/Dry	65	$12,625,340	$6,389,603	$19,014,943	$8,978,190	$5,525,040	$14,503,230	$33,518,173	$147	$118	$207
6	Mixed Waste Processing	71-89	$3,112,980	$3,340,735	$24,915,115	$7,384,560	$1,698,320 to $4,626,160	$9,082,880 to $12,010,720	$33,997,995 to $36,925,835	$141 $177	$154	$210 $229
			MSW Processing	$18,461,400								

No. of Households = 161,556

Notes
1 See table 3.9 for derivation of costs
2 Refer to Service Technical Appendix for diversion estimates
3 System costs divided by 161,556 households in Region of York in 1992

The total annual cost of the Wet/Dry system was estimated at $33.5 million, based on a disposal rate of $80/tonne. The total system cost per household was estimated at $207/hhld/year for the Wet/Dry system.

The total annual system cost of the Mixed Waste Processing system was estimated at $34 million if the compost is marketed, and $36.9 million if the compost was landfilled, based on a garbage disposal rate of $80/tonne. The total system cost per household was estimated at $210/hhld/year (compost marketed) and $229/hhld/year (compost landfilled).

3.5.4 Updated Unit Operating Costs

A meeting was held with Region of York staff (Flewelling. J., MacMillan, L, 1993) on June 22, 1993, to discuss preliminary study results based on the unit cost data presented in Section 3.5.2. Some of the unit rates originally used were updated as a result of information obtained at this meeting. The analysis presented in the Draft EA Input Document is based on the original costs. The Final EA Input Document will incorporate the updated costs, which are discussed below.

Blue Box Collection, Processing and Revenue

Blue Box collection costs of $76/tonne. Blue Box processing costs of $63/tonne, and Blue Box revenues of $27/tonne were suggested by Region of York staff.

Yard Waste Collection and Processing

Region of York staff agreed with the yard waste collection rate of $55/tonne. They recommend that the highest rate for yard waste composting quoted in the contract ($59/tonne) be used for future estimates.

Other Waste Diverted

The unit rate of $188/tonne for other waste management was retained.

Garbage Collection and Disposal

Region of York staff suggested a rate of $54/tonne for garbage collection, based on quoted rates for East Gwillimbury. A low rate of $45/tonne was suggested for garbage disposal. A high rate of $90/tonne will be maintained for updated estimates.

Wet Dry Collection and Processing Costs

The range of $75/tonne (RIS) and $130/tonne (Markham) for three stream collection were retained. Updated dry processing costs of $63/tonne provided by Region of York staff were used.

Wet waste processing costs of $60/tonne were used, based on Hensall data.

Mixed Waste Processing

The updated unit cost for mixed waste processing in York is $135/tonne. ($58/tonne capital plus $77/tonne operating) (See section 3.3.4 for rationale).

3.5.5 Updated System Costs

The updated unit operating costs and updated tonnages are presented in Table 3.11. Table 3.12 presents a summary of estimated system costs based on the updated unit operating costs.

As shown in the table, the total annual system costs for the Existing and Existing/Committed systems are estimated at $26.8 million, based on a disposal rate of $90/tonne. The total system cost per household is estimated at $166/hhld/year for each system.

The Direct Cost system annual cost is estimated at $23.8 million, and the cost for the Expanded Blue Box system is estimated at $23.4 million, based on the updated unit operating costs and a disposal rate of $90/tonne. The total system costs per household are estimated at $147/hhld/year and $145/hhld/year respectively.

The total annual three stream wet/dry system cost is estimated at $33.9 million, based on the updated unit operating costs, a wet/dry collection cost of $130/tonne, and a disposal rate of $90/tonne. The total system cost is estimated at $24.8 million per year when the three stream wet/dry collection rate drops to $75/tonne. The total system cost per household was estimated at $210/hhld/year for the higher wet/dry collection cost, and $153/hhld/year for the lower cost.

The total annual mixed waste processing system cost is estimated at $33.4 million (compost marketed), and $36.2 million (compost landfilled), based on the updated unit operating costs, and a disposal rate of $90/tonne. The total system cost per household is estimated at $207/hhld/year (compost marketed) and $224/hhld/year (compost landfilled). In all cases, the higher disposal rate of $90/tonne is used to reflect the fact that disposal costs and prices will likely

Backyard Composter Diversion @ 240 kg/composter

Table 3.11
Updated Unit Costs and Cost Estimates
Region of York

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection	Wet/Dry Collection	Wet Composting
Unit Cost	($/t)	$76	$63	$27	$66	$59	$25	$188	$54	$90	$135	$130	$75	$60
Existing	tonnes	26,805	26,805	26,805	16,300	16,300	6,972	6,087	142,150	142,150				
	cost ($)	$2,037,180	$1,688,715	$723,735	$1,075,800	$961,700	$174,300	$1,144,356	$7,676,100	$12,793,500				
Existing/	tonnes	26,805	26,805	26,805	16,300	16,300	6,972	6,087	142,150	142,150				
Committed	cost($)	$2,037,180	$1,688,715	$723,735	$1,075,800	$961,700	$174,300	$1,144,356	$7,676,100	$12,793,500				
User Pay	tonnes	50,965	50,965	50,965	16,300	16,300	26,046	6,087	98,917	98,917				
	cost ($)	$3,873,340	$3,210,795	$1,376,055	$1,075,800	$961,700	$651,150	$1,144,356	$5,341,518	$8,902,530				
Expanded	tonnes	62,893	62,893	62,893	16,300	16,300	26,046	6,087	86,988	86,988				
Blue Box	cost ($)	$4,779,868	$3,962,259	$1,698,111	$1,075,800	$961,700	$651,150	$1,144,356	$4,697,352	$7,828,920				
Wet/Dry	tonnes		62,893	62,893		16,300	26,046	6,087		69,063		166,181	166,181	17,925
	cost ($)		$3,962,259	$1,698,111		$961,700	$651,150	$1,144,356		$6,215,670		$21,603,530	$12,463,575	$1,075,500
Mixed Waste	tonnes	26,805	26,805	45,059	16,300	16,300	26,046	6,087	123,076		123,076			
Processing	cost ($)	$2,037,180	$1,688,715	$1,216,597	$1,075,800	$961,700	$651,150	$1,144,356	$6,646,104		$16,615,260			
- compost	tonnes									73,430				
landfilled	cost ($)									$6,608,696				
- compost	tonnes									42,038				
marketed	cost ($)									$3,783,430				

Notes:

- Blue Box Collection cost based on $319.011/4196 tonnes ($76/tonne) for Richmond Hill, 1992
- Blue Box processing cost based on $261259/4196 tonnes ($62/t - processing + truck rental) for Richmond Hill. A capital cost of $25/tonne is assumed and added to give $87/tonne
- Yard Waste collection cost based on $129,933/1967 tonnes ($66/tonne) for Richmond Hill, 1992
- Yard Waste processing cost based on $35/tonne for Richmond Hill
- Other Waste Diverted cost based on $75,000/400 tonnes ($188/tonne - from Oshawa transfer station in Durham) (Watson, 1993)
- Garbage Collection cost based on $17.95/capita*45,500 people(1991 census)/13,933 tonnes ($60/tonne - from Newmarket, 1992)
- Garbage Disposal cost is assumed at $80/tonne (same assumption as for Metro Toronto)
- Wet/Dry Collection cost based on Markham Wet/Dry study ($130/tonne - including bins) (LURA Group, 1992)
- See Service Technical Appendix for derivation of diversion estimates
- See tables 3.11 and 3.12 for updated diversion estimates and system costs

Garbage Disposal cost @ $90/tonne
Backyard Composter Diversion @ 240 kg/composter

Table 3.12
Summary of Updated Residential System Costs
Region of York

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	28	$3,112,980	$3,245,336	$6,358,316	$7,676,100	$12,793,500	$20,469,600	$26,827,916	$113	$39	$166
2	Existing/ Committed	28	$3,112,980	$3,245,336	$6,358,316	$7,676,100	$12,793,500	$20,469,600	$26,827,916	$113	$39	$166
3	User Pay	50	$4,949,140	$4,591,946	$9,541,086	$5,341,518	$8,902,530	$14,244,048	$23,785,134	$96	$59	$147
4	Expanded Blue Box	56	$5,855,668	$5,021,354	$10,877,022	$4,697,352	$7,828,920	$12,526,272	$23,403,294	$98	$67	$145
5A	Wet/Dry (H)	65	$12,625,340	$6,096,854	$18,722,194	$8,978,190	$6,215,670	$15,193,860	$33,916,054	$145	$116	$210
5B	Wet/Dry (L)	65	$7,283,850	$6,096,854	$13,380,704	$5,179,725	$6,215,670	$11,395,395	$24,776,099	$104	$83	$153
6	Mixed Waste Processing	71-89	$3,112,980	$3,229,324	$22,957,564	$6,646,104	$6,608,696 to $3,783,430	$13,254,800 to $10,429,534	$36,212,365 to $33,387,098	$147 to $184	$142	$224 to $207
			MSW Processing	$16,615,260								

No. of Households = 161,556

Notes
1. See table 3.11 for derivation of costs
2. Refer to Service Technical Appendix for diversion estimates
3. System costs divided by 161,556 households in Region of York in 1992

increase in the future. Costs developed using the lower rate are presented in Schedule C.

3.6 Cost Estimates for Region of Peel

The capital and unit operating costs for the six Peel residential systems are discussed below:

3.6.1 Capital Costs

Existing System Capital Costs

Capital costs for the existing system were not considered in this analysis, as it is in place at this time, and is assumed not to require additional capital expenditure.

Existing/Committed Capital Costs

The 5 year funding commitments for Region of Peel are (Future Urban Research 1993):

- $25,000,000 for new MRF
- $25,800,000 for 7 community recycling centres
- $38,500,000 for a new central composting facility, capacity 69,000 tonnes/year (may be shared with Halton). Discussions with Region of Peel staff confirmed that this estimate includes $10 million for purchase of 150,000 household carts.
- $500,000 for mini-recycling depots
- $500,000 for unexpected expenses.

Total $90,300,000.

For diversion estimates (on which unit cost estimates are based), the Region of Peel Existing/Committed scenario assumes that 1 urban community recycling centre, and 1 rural community recycling centre will be built within the five-year funding time frame. The Region has committed to 5 urban and 2 rural community recycling centres, but discussion with Regional staff indicated that it was reasonable to assume that 2 centres would go ahead (Williams, 1993).

Capital funding has been included and budgeted to construct a central composting facility in the Region (this may be shared with Region of Halton). If approved, the Region would then move to a three stream Wet/Dry collection system. Approval of the expenditure for a three stream Wet/Dry

system ($38.5 million) is somewhat uncertain, given the climate of restraint in Ontario at this time. If not approved in the near future, Regional staff feel that construction of the compost facility would be delayed until 2000 to 2001.

Direct Cost System Capital Costs and Revenues

Capital costs of the Direct Cost system are assumed to be the same as for the Existing/Committed system. Revenue from sale of bags/tags was estimated to be somewhere between $3 and $12 million/year, depending on the charge per bag/tag. The higher figure assumes a charge of $1/bag, and the use of an average of 100 bags/tags/single-family household/year. Multi-family households are not included in the Direct Cost estimates, as their waste is handled by private contractors.

Revenues from the Direct Cost system were not included in the cost analysis carried out, but are included in the municipal finance assessment (Future Urban Research 1993).

Total $90,300,000 (Existing/Committed)

Expanded Blue Box System Capital Costs

The Existing/Committed system in Peel will likely be able to handle the larger quantities of dry materials collected by the Expanded Blue Box system, after the new MRF is constructed.

Total $90,300,000 (Existing/Committed)

Wet/Dry System Capital Costs

Most of the facilities required for the three stream Wet/Dry system are included in the Existing/Committed system, which already includes capital allowances for the new MRF and central composting facility. The additional expenses had originally been estimated as follows:

- $9 million for 60 new trucks
- $12 million to provide roll-out carts to 120,000 single-family households. (This double counts an allowance of $10 million included in Peel's Existing/Committed system, but was included in the municipal finance analysis prior to clarification by Region of Peel staff. This will be updated in the Final EA Input Document).

Total $90,300,000 (Existing/Committed)
$21,000,000 additional capital costs
$111,300,000 total

The three stream Wet/Dry system would service single-family households only. The difficulties involved with providing three stream Wet/Dry to multi-family residents have not yet been resolved, therefore multi-family units were not included in the capital estimates. The capital cost of a three stream Wet/Dry collection truck ranges from $150,000 to $200,000. (Markham plans to test a truck costing $200,000). The capital cost of a packer truck is $100,000 to $120,000, so that the replacement fleet will be more expensive in a three stream Wet/Dry system.

Mixed Waste Processing System Capital Costs

This system would require an estimated $80 to $100 million capital expenditure for a mixed waste plant with a capacity of 230,000 tonnes/year. This estimate is based on scale-up of the Region of Durham estimate of $50 million for a mixed waste plant with a capacity of 112,000 tonnes per year, using the 6/10ths rule (see Section 3.4.1). If this system were adopted, it would eliminate the need for construction of the central composting facility and implementation of a three-stream Wet/Dry system (estimated cost $38,500,000) included in the Existing/Committed system. The costs of this system would therefore be:

- $25,000,000 for new MRF
- $25,800,000 for 7 community recycling centres
- $100,000,000 for a mixed waste processing plant
- $500,000 for mini-recycling depots
- $500,000 for unexpected expenses.

Total $151,800,000

3.6.2 Original Unit Operating Costs

Blue Box Collection and Processing

Blue Box collection costs of $100/tonne and Blue Box processing costs of $50/tonne were used, based on preliminary discussions with Region of Peel staff in spring 1993.

Blue Box revenues were estimated at $22/tonne, based on information from Region of Durham, since revenues for Peel were not broken out in their budget. (See original unit operating costs for Durham in Section 3.3.2).

Yard Waste

Yard waste collection costs were taken from an AMRC report and were based on the $74/tonne collection cost reported by Etobicoke for collection of bagged leaf and yard waste. (ORTECH International 1993).

Yard waste processing costs were taken from the AMRC report referenced above and were based on an allowance of $33/tonne for operation of an open windrow site, and $22/tonne for capital costs (for Waterloo, Ontario).

No revenues were included for compost sales

Backyard Composting

Backyard composting costs of $25/tonne were used to account for the capital and operating costs of running backyard composting programs. The costs were based on Compost Management Associates estimates of approximately $23/tonne for Region of Durham (Compost Management Associates, 1992), increased by approximately 10% to allow for some contingency costs.

Other Waste Diverted

Other waste diverted includes miscellaneous materials collected at depots and transfer stations, such as wood and brush, leaves and yard waste, scrap metal, OCC, ONP, drywall, tires, waste oil, batteries, propane tanks, paint products and clean fill. An estimate of $100/tonne was used to reflect the handling costs for these materials, which would be expected to be lower than the handling costs for Blue Box materials.

Garbage Collection and Disposal

Garbage collection costs of $60/tonne were used, based on Metro Toronto costs (Metropolitan Toronto Commissioner of Works, 1992).

Garbage disposal costs were assumed to be $80/tonne, which was the tipping fee charged at Britannia Road landfill as of May 1993.

Wet/Dry Collection and Processing Costs

Wet/dry collection costs were originally based on RIS preliminary estimates of $75/tonne for three-stream collection in Region of Durham (See Section 3.3.2).

Processing costs for dry materials in the Wet/Dry system were assumed to remain at $50/tonne, as with the Blue Box system. There may be some

efficiencies with the Wet/Dry system, but these are not taken into account at this stage.

Wet processing costs were assumed to be $55/tonne, based on Hensall Composting Facility data (Jacob, M. 1993).

Unit Operating Costs For Mixed Solid Waste Processing

MSW processing costs of $150/tonne were used for the initial estimate. The rationale for this cost is discussed in Section 3.3.2 for Region of Durham. The updated costs changed this value downward (See Section 3.6.4).

3.6.3 Original Estimated System Costs

The original unit operating costs, and the tonnages diverted by each processing method are shown in Table 3.13. A summary of the diversion, disposal and total system costs for each of the six residential systems, based on the original unit operating costs, is shown in Table 3.14. This table also shows the diversion system cost on a $ per household and $ per tonne basis, and the total system cost on a $ per household basis. The estimates were based on 240,228 households in Region of Peel in 1992 (See Service Appendix, Chapter 3).

The total annual system cost was estimated at $42.1 million for the Existing system and $41.4 million for the Existing/Committed system, based on a disposal rate of $80/tonne. The total system cost per household is estimated at $175/hhld/year and $172/hhld/year for the two systems respectively.

The Direct Cost and Expanded Blue Box systems had similar estimated costs at $39.6 million/year and $39.3 million/year, based on a disposal rate of $80/tonne. The total system cost per household was estimated at $165/hhld/year and $164/hhld/year respectively for the two systems.

The total annual system cost of the three stream Wet/Dry system is $37.9 million, based on a disposal rate of $80/tonne. The total system cost per household was estimated at $158/hhld/year for the three stream Wet/Dry system.

The total annual system cost of the Mixed Waste Processing system was estimated at $58.9 million if the compost was marketed, and $64.6 million if the compost was landfilled, based on a garbage disposal rate of $80/tonne. The total system cost per household was estimated at $245/hhld/year (compost marketed) and $269/hhld/year (compost landfilled).

Garbage Disposal cost @ $80/tonne
Backyard composter diversion @ 240 kg/composter

Table 3.13

Original Unit Costs and Cost Estimates
Region of Peel

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection
Unit Cost	($/t)	$100	$50	$22	$74	$55	$25	$100	$60	$80	$150	$75
Existing	tonnes	37,454	37,454	37,454	7,661	7,661	13,641	5,246	253,329	253,329		
	cost ($)	$3,745,400	$1,872,700	$823,988	$566,914	$421,355	$341,025	$524,600	$15,199,740	$20,266,320		
Existing/ Committed	tonnes	41,204	41,204	41,204	7,661	8,161	16,521	11,996	239,449	239,449		
	cost($)	$4,120,400	$2,060,200	$906,488	$566,914	$448,855	$413,025	$1,199,600	$14,366,940	$19,155,920		
Direct Cost	tonnes	85,184	85,184	85,184	22,175	22,675	28,293	9,506	172,546	172,546		
	cost ($)	$8,518,400	$4,259,200	$1,874,048	$1,640,950	$1,247,125	$707,325	$950,600	$10,352,760	$13,803,680		
Expanded Blue Box	tonnes	103,318	103,318	103,318	7,661	8,161	28,293	11,996	165,564	165,564		
	cost ($)	$10,331,800	$5,165,900	$2,272,996	$566,914	$448,855	$707,325	$1,199,600	$9,933,840	$13,245,120		
Wet/Dry	tonnes		103,318	103,318		61,933	28,293	11,996		111,791		277,042
	cost ($)		$5,165,900	$2,272,996		$3,406,315	$707,325	$1,199,600		$8,943,280		$20,778,150
Mixed Waste Processing	tonnes	41,204	41,204	65,191	7,661	8,161	28,293	11,996	227,677		227,677	
	cost ($)	$4,120,400	$2,060,200	$1,434,191	$566,914	$448,855	$707,325	$1,199,600	$13,660,620		$34,151,550	
- compost landfilled	tonnes									107,844		
	cost ($)									$8,627,480		
- compost marketed	tonnes									35,983		
	cost ($)									$2,878,640		

Notes
1 See Service Technical Appendix for derivation of tonnages managed by different methods
2 See Tables 3.15 and 3.16 for updated diversion estimates and costs

Backyard composter diversion @ 240 kg/composter

Table 3.14

Summary of Original Residential System Costs
Region of Peel

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	20	$4,312,314	$2,335,692	$6,648,006	$15,199,740	$20,266,320	$35,466,060	$42,114,066	$104	$28	$175
2	Existing/ Committed	25	$4,687,314	$3,215,192	$7,902,506	$14,366,940	$19,155,920	$33,522,860	$41,425,366	$101	$33	$172
3	Direct Cost	46	$10,159,350	$5,290,202	$15,449,552	$10,352,760	$13,803,680	$24,156,440	$39,605,992	$106	$64	$165
4	Expanded Blue Box	48	$10,898,714	$5,248,684	$16,147,398	$9,933,840	$13,245,120	$23,178,960	$39,326,358	$106	$67	$164
5	Wet/Dry	65	$12,393,825	$8,206,144	$20,599,969	$8,384,325	$8,943,280	$17,327,605	$37,927,574	$100	$86	$158
6	Mixed Waste Processing	66-89	$4,687,314	$3,485,506	$42,324,370	$13,660,620	$2,878,640 to $8,627,480	$16,539,260 to $22,288,100	$58,863,630 to $64,612,470	$150 $202	$176	$245 $269
			MSW Processing	$34,151,550								

Notes:
1. See Table 3.13 for derivation of costs
2. See Tables 3.15 and 3.16 for updated cost and diversion estimates

3.6.4 Updated Unit Operating Costs

A meeting was held with Region of Peel staff (Williams, Morgan Fraser, 1993) on June 18, 1993, to discuss preliminary study results based on the unit cost data presented in Section 3.6.2. Some of the unit rates originally used were updated as a result of information obtained at this meeting. The analysis presented in the Draft EA Input Document is based on the original costs. These will be updated in the Final EA Input Document.

Blue Box Collection and Processing

Based on further discussions with Region of Peel staff, it was determined that Blue Box material processing net of revenue is approximately $30/tonne in Peel. Since Blue Box revenues for Region of Peel were not broken out in their budget, the updated Region of Durham average Blue Box revenue of $26/tonne was used, and Blue Box processing costs were updated to $56/tonne ($30 plus revenue).

An updated Blue Box collection cost of $125/tonne was used, based on these discussions.

Yard Waste

Yard waste collection and processing costs of $74/tonne and $55/tonne respectively were confirmed as being reasonable by Regional of Peel staff.

Backyard Composting

Backyard composting costs of $25/tonne were confirmed as being reasonable by Region of Peel staff.

Other Waste Diverted

An rate of $140/tonne for other waste diverted is used based on discussions with Region of Peel staff, who estimated that the cost for collection and processing of these materials is between $100 (originally used by RIS) and $188/tonne (reported by Region of Durham).

Garbage Collection and Disposal

Updated garbage collection costs of $40/tonne were used, based on discussions with Region of Peel staff.

Garbage disposal costs were based on a $70/tonne rate to dispose of waste at landfill, and $98/tonne to incinerate the waste at the Peel Resource Recovery

Inc. (PRRI) incinerator (including $68/tonne for incineration, and balance for disposal of residues to landfill). A sensitivity of the system costs to disposal costs was run, using both the high and low disposal costs. The results based on the lower disposal cost may be found in Schedule D.

Wet/Dry Operating Costs

A range of $90/tonne to $130/tonne was used for three stream Wet/Dry collection costs. A collection cost at $90/tonne was felt to be more reasonable for Peel than $75/tonne originally used by RIS (Williams, 1993). The $130/tonne rate is estimated for Markham (LURA Group, 1993)

Processing costs for dry materials in the Wet/Dry system were assumed to remain at the updated estimate of $56/tonne, as with the updated Blue Box systems.

Wet processing costs of $60/tonne were based on the range of estimates provided for the Hensall Composting Facility (Jacob, M. 1993), and confirmed by Region of Peel staff.

Mixed Waste Processing Costs

Mixed waste processing costs were updated to $123/tonne, consisting of $77/tonne operating cost, and $46/tonne for capital ($80 million at 10% for 15 years, for 230,000 tonne/year plant).

3.6.5 Updated System Costs

The updated unit operating costs and updated tonnages are presented in Table 3.15. Table 3.16 is a summary of the total system costs based on the new unit operating costs (as suggested by Region of Peel staff).

As shown in Table 3.16, the total annual system costs for the Existing and Existing/Committed systems are estimated at $42.8 million and $42.5 million, respectively based on a disposal rate of $98/tonne. The total system costs per household are estimated at $178/hhld/year and $177/hhld/year respectively for the two systems.

The Direct Cost and Expanded Blue Box systems have similar estimated annual system costs, at $41.8 million and $42.3 million respectively, based on a disposal rate of $98/tonne. The total system costs per household are estimated at $174/hhld/year and $176/hhld/year respectively.

The total annual system cost for the Wet/Dry system is estimated at $56 million, based on the updated unit operating costs, a wet/dry collection cost of

$130/tonne and a disposal rate of $98/tonne. The total annual system cost is estimated at $44.9 million when the wet/dry collection rate drops to $75/tonne. The total system cost per household is estimated at $233/hhld/year for the higher wet/dry collection cost, and $187/hhld/year for the lower cost.

As shown in Table 3.16, the total estimated annual system cost for the Mixed Waste Processing system is $53.1 million (compost marketed), and $59.3 million (compost landfilled), based on a disposal rate of $98/tonne. The total system cost per household is estimated at $221/hhld/year (compost marketed) and $247/hhld/year (compost landfilled).

3.7 Cost Estimates for Region of Halton

Cost estimates were not carried out six systems for the Region of Halton, since Halton has its own landfill which was recently opened. Halton is therefore not part of the GTA landfill site selection process. However, it was felt that there was value to addressing Halton costs using the methods applied to the other GTA Regions for comparison. Costs are therefore presented for the Existing and Existing/Committed systems.

3.7.1 Capital Costs

Existing System Capital Costs

Capital costs for the existing system were not considered in this analysis, as it is in place at this time, and is assumed not to require additional capital expenditure.

Existing/Committed Capital Costs

The 5 year funding commitments for Region of Halton are (Future Urban Research, 1993):

- $500,000 for new HHW depot
- $25,000,000 for Regional composting facility (note: no provision in 5-year forecast and 1993 capital budget)
- $255,000 for recycling vehicles (note: to be sold in conjunction with contract for collection of recyclables)
- $207,000 for change in HHW service level in Burlington
- $87,700 to cover changes in recycling contract operations
- $34,300 for new Igloos
- $107,400 for waste reduction education and display materials

Total $26,191,400.

3.7.2 Unit Operating Costs

Blue Box Collection and Processing

Blue Box collection costs of $42.60/tonne and Blue Box processing costs of $87/tonne were used, based on discussions with Region of Halton staff and MOEE (WRO) staff.

Blue Box revenues were estimated at $42.88/tonne, based on information from Region of Halton and MOEE (WRO).

Yard Waste

Limited yard waste cost information was obtained from Halton Region municipalities. Therefore yard waste collection costs were taken from an AMRC report and were based on the $74/tonne collection cost reported by Etobicoke for collection of bagged leaf and yard waste. (ORTECH International, 1993).

In the absence of other data, yard waste processing costs were taken from the above AMRC report and were based on an allowance of $33/tonne for operation of an open windrow site, and $22/tonne for capital costs (for Waterloo, Ontario).

No revenues were included for compost sales.

Backyard Composting

Backyard composting costs of $25/tonne were used to account for the capital and operating costs of running backyard composting programs. The costs were based on Compost Management Associates estimates of approximately $23/tonne for Region of Durham, increased by approximately 10% to allow for some contingency costs (Compost Management Associates, 1992).

Other Waste Diverted

Other waste diverted includes miscellaneous materials collected at depots and transfer stations, such as wood and brush, leaves and yard waste, scrap metal, OCC, ONP, drywall, tires, waste oil, batteries, propane tanks, paint products and clean fill. In the absence of better cost information for Halton Region, an assumed unit cost of $188/tonne was used based on Durham data (Watson, 1993).

Garbage Disposal @ $150/tonne
Backyard composter diversion @ 240 kg/yr

Table 3.17
Unit Costs and Cost Estimates
Region of Halton

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	Backyard Composting Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	High Wet/Dry Collection	Low Wet/Dry Collection	Wet Composting
Unit Cost	($/t)	$43	$87	$43	$74	$55	$25	$188	$38	$150	$150	$130	$75	$55
Existing	tonnes	26,694	26,694	26,694	15,000	15,000	6,168	356	88,800	88,800				
	cost ($)	$1,137,164	$2,322,645	$1,144,639	$1,110,000	$825,000	$154,200	$66,928	$3,374,400	$13,320,000				
Existing/ Committed	tonnes	31,744	31,744	31,744	15,000	15,000	7,368	356	82,550	82,550				
	cost($)	$1,352,294	$2,762,045	$1,361,183	$1,110,000	$825,000	$184,200	$66,928	$3,136,900	$12,382,500				
										$0				

Notes:

- Blue Box collection costs based on information received from MOEE - WRO, Oct.13, 1993
- Blue Box processing costs based on information received from MOEE - WRO, Oct.13, 1993
- Blue Box revenues based on information received from MOEE - WRO, Oct.13, 1993
- Yard Waste collection cost (as per Peel) based on Etobicoke cost of $74/tonne for bagged leaf and yard waste.
- Yard Waste processing (as per Peel) based on $22/tonne capital, $33/tonne operating (for Waterloo, Ontario; from AMRC report).
  This is similar to Hensall Composting Facility ($40-60/tonne, without pre-processing).
- Other Waste Diverted cost based on $75,000/400 tonnes ($188/tonne - from Oshawa transfer station in Durham)
- Garbage Collection cost based on information received from area municipalities (RIS survey - Feb/93)
- Garbage Disposal cost based on Halton tipping fee of $150/tonne (Lynn Johns - Region of Halton)
- Wet Composting cost based on Hensall Compost Facility for in-vessel
- refer to Service Technical Appendix for derivation of diversion estimates

Garbage Disposal @ $150/tonne
Backyard composter diversion @ 240 kg/yr

Table 3.18
Summary of Residential System Costs
Region of Halton

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	35	$2,247,164	$2,224,134	$4,471,299	$3,374,400	$13,320,000	$16,694,400	$21,165,699	$93	$41	$193
2	Existing/ Committed	40	$2,462,294	$2,476,991	$4,939,285	$3,136,900	$12,382,500	$15,519,400	$20,458,685	$91	$45	$187

No. of Households = 109,680

Notes: - Gerbage Disposel at $150/tonne
- see Table 3.17 for derivation of costs
- refer to Service Techical Appendix for diversion estimates

Garbage Collection and Disposal

A garbage collection cost of $38/tonne was used, based on information provided by the municipalities of Burlington, Halton Hills and Milton (Anderson, P, Antonio, P, Sargeant, P, 1993).

A garbage disposal cost of $150/tonne was used, based on the Halton Region tipping fee provided by Halton Region staff (Johns, L. 1993).

3.7.3 System Costs

The unit operating costs and quantities of materials handled (tonnes) are presented in Table 3.17. Table 3.18 is a summary of the total estimated system costs based on the unit operating costs.

As shown in Table 3.18, the total annual system costs for the Existing and Existing/Committed systems are estimated at $21.2 million and $24.1 million, based on a disposal rate of $150/tonne. The total system costs per household are estimated at $193/hhld/year and $220/hhld/year for the two systems.

3.8 References

Compost Management Associates, 1992. *A Field Examination of the Cost Effectiveness of Waste Diversion Potential and Homeowner Acceptance Backyard Composting Units. Phase II-The Pickering Research.*

Future Urban Research Municipal Finance Technical Appendix – GTA 3Rs Analysis, 1993.

LURA Group. 1992. *Revised Funding Proposal for the Town of Markham's Demonstration Model Community Programme.* Prepared for the Ministry of the Environment.

Metropolitan Toronto Commissioner of Works. 1992. *Memorandum:Preliminary Financial Analysis of the Blue Box Program.* (February 27). Prepared for the Metropolitan Toronto Works Committee.

Metropolitan Toronto Works Department, 1992. Annual Report.

Ortech International. 1993. AMRC *Leaf and Yard Waste Composting Study.* Prepared for the Association for municipal Recycling Co-ordinators.

Proctor and Redfern Limited Town of Cobourg's Curbside "User Pay" Feasibility Study, January 1993.

Resource Integration Systems Limited. 1990. Generator Pay Study.

VHB Research and Consulting, Inc. 1993. *True Costs of Waste Management in Ontario*. Prepared for the Ontario Ministry of the Environment.

Personal Communications

Anderson, P. 1993 Waste Management Department, city of Burlington. Personal communication, October 1993.

Antonio, P. Milton Public Works Department, 1993. Personal communication, October 1993.

Commidge, R. Town of Richmond Hill, 1993. Personal communication June 1993.

Egli, P. Region of Durham Finance Department, 1993. Personal communication, July 1993.

Flewelling, J. Region of York Works Department, 1993. Personal communication, June 1993.

Gale, M., Town of Whitby. 1993. Personal communication, June 1993.

Jacob, M., Hensall Composting Facility. 1993. Personal communication, June 1993.

Johns, L. Halton Region. Personal communication, October 1993.

MacMillan, L. Region of York Works Department, 1993. Personal communication, June 1993.

Michael, T. Metro Works Department, 1993 Personal communication, June 1993.

Morgan-Fraser, L. Region of Peel Works Department, 1993. Personal communication, June 1993.

Nanda, A. Metro Works Department, 1993. Personal communication, June 1993.

O'Leary, D., BFI Oshawa. 1993. Personal communication, June 1993.

Pollock A. Metro Works Department, 1993 Personal communication, June 1993.

Sargeant, P. Halton Hills, 1993. Personal communication, October 1993.

Watson, P., Region of Durham. 1993. Personal communication, June 1993.

Williams, G., Region of Durham. 1993. Personal communication, June 1993.

4.0 IC&I SYSTEM COST ESTIMATES

4.1 General

The costs of Residential and IC&I waste management systems were estimated separately for this study. The costs for the IC&I systems were estimated for the entire GTA based on aggregated waste generation estimates for each region in the GTA and diversion estimates for the entire GTA region.

This chapter presents the estimated costs for the six IC&I systems presented and discussed in the Service Technical Appendix, and also presents the basis for these estimates. The six IC&I systems are as follows:

IC&I System 1	Existing
IC&I System 2	Existing/Committed
IC&I System 3	Extended 3Rs Regulations
IC&I System 4	Expanded 3Rs Regulations
IC&I System 5	Expanded 3Rs Regulations with organics
IC&I System 6	No unprocessed waste to landfill

Section 4.2 of this chapter describes the approach to estimating the cost of these systems. Section 4.3 summarizes the estimated costs for the systems.

4.2 Methodology

4.2.1 Overview

Determining IC&I waste management costs in GTA is a difficult task. Very little information is available on the costs of IC&I waste management systems. Unlike the residential sector, where budgets are maintained by local and regional municipalities, there are no central budget sources for the IC&I sector. IC&I waste management is carried out by the private sector, and there are currently no data reporting requirements in place.

Management of IC&I wastes is accomplished in many ways. The costs and where they are borne depend on many factors. These include:

- the volume of material handled
- the type of waste material
- technical limitations on processing
- the market value of the waste material after processing
- whether collected material is clean, source separated, commingled with other materials, or in a mixed waste stream
- the level of processing (e.g. loose vs baled)

- the frequency of collection
- the geographic location of clients and the concentration of clients in the areas served by the hauler or recycler.

Private haulers and recyclers offer a wide range of programs. Some waste management companies concentrate only on very specific materials or a mixture of similar materials, such as paper. Other companies handle a diverse range of materials. These companies may collect a range of materials from one source and they may also collect different materials from different sources. Some programs require that wastes be source separated while in others mixed wastes are collected for subsequent separation at another facility. Some companies collect from a large geographic area while others serve a smaller locality. Similarly, some companies service only the largest generators of waste materials, while others will provide services to small generators.

There are over 220 private sector companies providing a range of hauling, processing and marketing services for IC&I wastes in GTA. A complete listing of all IC&I recycling companies in GTA is available through the Recycling Council of Ontario (RCO, 1992).

In conjunction with work to develop estimates of current levels of diversion of waste materials, RIS conducted a survey of a selection (approximately 60) of companies providing a range of hauling, processing and marketing services in GTA (questionnaire included in Schedule O, Volume 2 of the Service Technical Appendix). In total, 54 companies were contacted, and 37 responded to some or all of the survey questions. In these surveys RIS guaranteed confidentiality, so that specific companies will not be named in this report. Similarly, RIS clients from whom information was obtained on a confidential basis will not be named specifically in this report.

Information was obtained through the survey from two of the largest, 5 middle-level companies and 30 small hauling and recycling companies was obtained. However, most private haulers and recyclers were unwilling to divulge proprietary information concerning their operations and capacities. Also, haulers and recyclers find it very difficult to quote the type of general costs required for this study as costs depend very much on the specific circumstances.

For these reasons it is difficult to generalize costs quoted by haulers and recyclers without knowing in greater detail how they allocate their operating and capital costs.

In the absence of comprehensive and reliable information on costs for IC&I waste management systems in GTA, estimates of the costs of the six IC&I systems considered in this analysis have been based on assumed unit costs for handling each waste material. The approach is described below. The costs presented are

approximate only, but are considered to be at an adequate level of detail for the comparative evaluation of systems carried out by the cost discipline.

4.2.2 Approach to Cost Estimates

The waste generation, allocation and diversion estimates used in this analysis are described in Chapters 5 and 6 of the Service Technical Appendix. The cost of the IC&I waste management system options was developed by assigning unit rates per tonne for the costs for collection, recovery and disposal to various material categories.

The composition of the GTA IC&I waste stream was estimated using the following categories:

- Old Corrugated Cardboard (OCC)
- Old Newsprint (ONP)
- Mixed Paper (note: in some cases fine paper fractions have been identified)
- Glass
- Ferrous Metal
- Non-ferrous Metal
- High-density Polyethylene (HDPE)
- Polyethylene Terephthalate (PET)
- Other Plastics
- Food Wastes
- Yard Wastes
- Wood
- Construction and Demolition (C&D) Wastes
- Other Wastes

Unit cost estimates for each waste material category represent the unit price charged to IC&I establishments for the collection of recyclables or disposal of waste materials. It has been assumed for the purpose of this analysis that the prices charged by haulers, recyclers and end markets reflect the capital cost of the waste management infrastructure, the cost of operating the waste management systems as well as profits.

It has been assumed that profits would be used in part to support increases in capacity and technological improvements. Therefore, required adjustments to the infrastructure would be reflected in the unit prices charged. It has also been assumed that the private sector haulers, recyclers and end markets would expand collection and processing capacity to handle all materials targeted by the various IC&I systems considered in the GTA 3Rs analysis. Therefore, all of the costs associated with providing increased capacity would be reflected in the price charged to generators.

For each waste management system, the assumed unit costs of handling each material have been multiplied by the estimated quantity of the corresponding material diverted. The method and range of estimates of diversion for each system are summarized in Chapter 6 of the Service Technical Appendix. Estimates of diversion and of the costs of the waste management systems have been based on estimated 1992 values (in Canadian $) for illustrative purposes.

The overall diversion system cost has been estimated by summing the costs of diverting each different material as calculated above. Similarly, the cost of disposing of material is estimated by multiplying the quantity of material estimated to be disposed by the assumed unit cost for disposal. The overall system costs have been estimated by summing the costs of handling all materials, including all material diverted and all material disposed.

Potential revenues available from the sale of secondary materials has not been factored into the analysis as a separate item. The value of a material (due to market demand and recyclability) is assumed to be reflected in the price charged to the generator. This would mean that higher-value or more readily recyclable materials such as OCC would have a lower handling cost to the generator than other materials such as boxboard. Traditionally strong markets, existing infrastructure and accepted practice would lead to the lower unit cost.

At this stage of the study, for a given material, the unit costs have been assumed to be the same for all systems, regardless of the quantities of material handled. This does not account for any economies realized through further market development and from larger volumes of materials handled. This approach has been considered reasonable for the GTA 3Rs analysis given the limitations of the available data.

The internal costs incurred by individual waste generators are not reflected in the unit rates (prices) used for this analysis. These may include the cost of purchasing recycling bins, staff time in source separating waste, monitoring and reporting waste generation and preparing waste reduction plans, the cost of operating balers and compactors and the cost of renting additional storage space. It has been assumed that these costs, while they may be significant to individual generators, are relatively small compared to the overall system cost and have not been included in this analysis.

The assumptions on which estimates of the unit costs for the IC&I waste management systems were developed are discussed below. It should be stressed that costs for all systems have been developed using "ballpark" prices for recycling and disposing of different materials obtained through discussion with GTA recyclers, and general IC&I waste collection and disposal rates obtained through discussions with haulers.

These costs are likely to change as economic factors change. As an example, the tipping fee for IC&I waste dropped from $150/tonne, to $80-90/tonne during the course of this study, which had a significant impact on estimated costs. Similarly, the lower costs for exporting waste would have a similar impact.

The economic viability of waste diversion depends on numerous factors, including the strength of local economies, consumer preferences, technology, the strength of secondary material markets, procurement practices, the availability of inexpensive export options, the cost of disposal vs diversion etc. Because all of the factors are changing frequently, the costs presented in this document should be considered of value only for comparative purposes.

4.2.3 Estimate of Waste Collection Costs

There are three basic waste collection services provided to the IC&I sector. These are rear packer collection, bulk lift container and front-end loader. Each of these methods, and the available information on unit costs for these methods is described below.

Front-end Loader Service

With a front-end loader service, customers are provided with bins for storing waste ranging in size from 2 to 10 cubic yard (cy). The hauler empties the bins on either a regular schedule (e.g. once per week) or on a call basis using a front-end loader truck. A typical front-end loader compactor truck can service approximately 30 accounts before being filled, and would service up to 100 accounts per day.

Costs to the generator usually are charged on a per collection basis. This includes the cost of collection, and the cost of disposal of the waste at the landfill or transfer station and sometimes the cost of storage bins (sometimes also charged separately). The charge is based on the location of the client and the weight of waste collected. Typically heavier loads such as generated by restaurants, are charged a higher price than lighter loads such as from service stations. This is due to the cost to the hauler in tipping fees which need to be allocated to the appropriate generators and to the additional wear and tear on equipment.

Table 4.1 presents costs quoted for three sizes of storage bins (costs were not provided for larger bins of up to 10 cubic yard capacity).

Table 4.1

Front-End Loader Collection Costs

Collection Cost	2 cubic yards	4 cubic yards	6 cubic yards
$/lift*	$20	$31	$41.50
$/cubic yard**	$10	$7.75	$6.92
$/tonne**	$210	$163	$145

Source: Tendered quotes to one RIS client (confidential)
Note: * This collection cost includes the cost of disposal
** One hauler quoted a density of 47.6 kg/cy typically used for cost estimates (confidential source)
** The costs presented assume bins are completely full

Roll-Off Container Service

With a roll-off container service, customers are provided with bins for storing wastes ranging in size between 12 and 40 cubic yard. The hauler collects the bin either on a regular schedule or on a call basis. Bins may be open-top bins which do not allow compacting or closed-top bins which either are combination compactors or may be attached to stationary compactors.

Haulers can service and drop only one bin at a time. Therefore, costs generally are quoted in two ways: on a per tonne basis (because weights can be attributed to the corresponding generator) and on a per-collection basis. Costs to the generator include collection and disposal of the waste at landfill or transfer station. The cost of renting bins is either included or charged separately.

The costs quoted for 3 different sizes of bins are presented in Table 4.2.

Table 4.2

Roll-Off Container Collection Costs

Collection Cost	40 cubic yard Open Top	20 cubic yard Compacted***
$/lift	$80	$165
$/cubic yard*	$2	$8.25
$/tonne (density 47.6 kg/cy)**	$132	$148
$/tonne (density $142.8 kg/cy)***	$42	$58

Source: Tendered quotes to one RIS client (confidential)
Note: * This cost/tonne includes the cost of disposal ($90/tonne)
** One hauler quoted a density of 47.6 kg/cy, typically used for cost estimates (confidential source)
*** A density of 142.8 kg/cy was assumed for the compacted bin
The costs presented assume bins are completely full

Packer Truck Service

Packer truck service refers to collection of waste using a truck that is loaded manually, similar to those used for residential garbage collection. Packer trucks are typically used for clients that do not have the space or access for front-end loader bins such as street-side retail, strip-malls and some restaurants, and for those that need frequent collection. The costs for this service are quoted on a per collection basis because no accurate weighing can take place at the time of collection. They include both the cost of collection and disposal at landfill or transfer station. There is no method for weighing wastes collected on a client by client basis.

The costs quoted for this type of contract for a daily collection service for one RIS client was $164/collection. Based on the waste generation weights provided by the client for this contract, the cost per tonne was estimated at $131/tonne (this cost includes a tipping fee which was not detailed.)

Based on the available information, a collection cost of approximately $50/tonne was used in this analysis. A disposal rate of $85/tonne (average of tipping fees charged in GTA in mid-1993) was added to collection costs to estimate total waste management costs at $135/tonne.

4.2.4 Estimate of Handling Costs by Waste Material Category

The unit costs assumed for each material category are presented below by material. In most cases costs cited have been provided to RIS on a confidential basis by either RIS clients, or haulers and recyclers surveyed as part of this study (again, confidentiality was guaranteed).

Office paper costs

- One source contacted by RIS was being charged $91/tonne for collection of mixed office paper. For this contract the client was required to purchase bins separately from the recycler.

- For services which involve further processing such as shredding of confidential documents, a higher cost would likely be charged. This has not been considered in this analysis as no reliable information exists on the quantities handled.

- One recycler contacted by RIS quoted a cost for collection of office paper of between $97 and $105 per tonne. This range reflected different costs for fine paper (computer printout and white ledger) and mixed office paper.

- A range of $91 to $105/tonne has been used in this analysis for the costs of handling fine paper and mixed paper. This may underestimate the cost of handling mixed paper because the mixed paper category in this analysis also includes boxboard, kraft and other fibres such as fibre cores (which are very dense) and which may incur a higher handling cost, and have a much lower market value than office paper. No reliable data were available on the cost of handling these materials.

OCC

- One RIS client was being charged approximately $25/week for a once per week collection of OCC in 6 cy bins using a front-end loader ($4.17/cy). Assuming a density of 45 kg/cy for loose OCC, the cost would be approximately $93/tonne.

- Other sources have quoted costs as high as $7/cy or $155/tonne (density of 45 kg/cy) for collection of loose OCC with a weekly packer truck service. Another source was being charged from $139/tonne in 1991 to $151/tonne in 1992, for a 3-times-per-week service.

- A cost of $90/tonne for handling OCC has been assumed for this analysis on the basis that firm markets are available for this material, it is relatively easy to process, and should be more economical to manage (by the fibre recycler) than other materials.

Mixed Office Programs

- One RIS client is provided with a mixed recycling program. This includes, on a weekly basis, collection of 180 kg of office paper, 105 kg of newspaper and 34 kg of mixed food and beverage metal containers. On a yearly basis, total diversion is approximately 16.6 tonnes of waste material. The cost of collection is $185/month or $2,220/year. This is equivalent to approximately $133.50/tonne. Desk-side collection bins and Otto carts are provided by the recycling operator. These costs are believed to be on the higher end of costs for such a service.

  It is assumed that the addition of glass and plastics to such a program would increase the costs, because of the additional handling and processing of these materials.

  Mixed papers, food and beverage containers made of glass, ferrous and non-ferrous metals, and various plastics are frequently source separated from the garbage and collected as commingled streams. Generally papers may be collected commingled. Glass is usually stored separately while metals and plastics typically are commingled. All of these generally may be collected together. This is because the volumes of waste generated by individual generators would not be sufficient for it to be cost-effective for one company to collect one material only. Also, having individual storage bins would be problematic for some waste generators. For most of these materials, separation at a processing facility is viable (although plastics present some problems of identification).

  Based on the above considerations, a cost of $140/tonne has been assumed for the collection of glass containers, mixed metal containers and mixed food and beverage plastic containers.

Glass

- The SWEAP Waste Composition Study indicates that in most IC&I sectors the majority of glass waste in the IC&I sector is container glass (excluding construction/demolition/renovation). (Proctor & Redfern Ltd., SENES Consultants, 1991). This was indicated also by other studies cited in the SWEAP document. In this analysis, the majority of glass has been assumed to be container glass. In many cases (food/beverage) this would be collected commingled with other container wastes. A cost of $140 per tonne has been assumed for processing this stream. In the absence of reliable information, a cost of $140/tonne has been assumed for handling other container glass as well.

- Little information is available on the cost of handling glass wastes other than container glass (such as plate glass). It is believed that except for high volumes of homogeneous glass material, most of this material is probably currently disposed in landfill. A cost of $140 per tonne has been assumed as a preliminary estimate for the handling of non-container glass wastes for lack of available data.

Metals

- High volume, homogeneous scrap metals have traditionally been recycled. It has been assumed that if a demand for secondary metals exists, new sources of valuable scrap metal will continue to be identified. These have been assumed to be collected at zero cost to the generator. As a preliminary estimate, it has been assumed that 20% of the metal waste generated is relatively high volume scrap metal with an appreciable market value to be collected at zero cost to the generator.

- A significant portion of the metal waste stream has been assumed to be a dispersed and diverse range of scrap metals in relatively low quantities from a large number of different generators. These would include durable goods such as office fixtures, old machinery parts, containers (other than food and beverage containers) such as aerosol cans and paint cans, strapping and wire. Little information is available on the cost of handling such materials. It has been assumed that while the metal has a value in the market, the diversity and low volumes generated by individual generators is such that there would be a cost to the generator for collection and handling. This has been assumed to be $120 per tonne. This may be a high estimate for larger volumes from individual establishments. It may be low if it is commingled with

other wastes (refer to the mixed waste handling cost discussed below). However, there likely would be a wide range of programs and costs for collecting and handling metal wastes, so this likely is a reasonable preliminary estimate.

It has been assumed that the various low volume, diverse scrap metals as described above make up 80% of the metals waste stream. NAPP indicated that a significant portion of packaging materials was non-container metals such as strapping and wire (NAPP, 1988 survey). Similarly, the SWEAP Waste Composition Study indicated that much of metal waste was non-container waste (Proctor & Redfern, SENES Consultants Ltd., 1991).

For this analysis, 30% of the ferrous metal waste stream has been assumed to be food and beverage containers. The remaining 50% would be other ferrous metal wastes described above, predominantly in the manufacturing sector, the transport, communications and utilities sector and the commercial services sector. Similarly, 30% of the non-ferrous metal waste stream has been assumed to be food and beverage containers, while 50% would be other non-ferrous metal wastes as described above. These estimates of the proportion of food and beverage containers may be high.

- Most food and beverage container metals likely would be collected as a commingled waste. For this analysis a handling cost for these materials of $140 per tonne has been assumed.

Plastics

- The high volume, homogeneous plastics, particularly from the manufacturing sector, traditionally have been recycled. It has been assumed that with the emphasis on recycling, new sources of scrap plastics are being identified. These are assumed to be collected at zero cost to the generator. As a preliminary estimate, it has been assumed that 15% of the plastics waste generated is relatively high volume scrap plastic that is collected at zero cost to the generator.

- It is assumed that in many cases plastic containers are collected as a commingled waste stream and collected together with other wastes such as paper, glass and metal containers. The SWEAP Waste Composition Study indicates that the proportion of plastics that are containers is relatively low (Proctor & Redfern, SENES Consultants Ltd., 1991). For this analysis, it has been assumed that 20% of the plastics are containers and collected at an assumed cost of $140 per tonne. This may be high.

- PET and to a lesser extent, HDPE predominantly are used as containers (PET particularly for food and beverage). These are not generated in sufficient quantities by individual IC&I generators for it to be cost-effective for haulers and recyclers to collect and handle separately. In most cases PET and HDPE would be collected together, frequently commingled with metal food and beverage containers. A cost of $140 per tonne therefore has been assumed for the collection and handling of all PET and HDPE.

- The most significant portion of the plastics waste stream has been assumed to be a dispersed and very diverse range of wastes. These would include packaging materials such as film plastics (the largest proportion in many sectors) (Proctor and Redfern, SENES Consultants Ltd., 1991), styrofoam packages and durable consumer goods. Little information is available on the cost of handling these materials. Most of such plastics, particularly film, currently are disposed in landfill (Horn, 1993, Rafferty, 1993).

  It has been assumed that these various low-volume mixed plastics wastes make up 65% of the mixed plastics waste stream.

  Because of the very low density of some plastic materials, the costs (cost per tonne) of collection are high relative to other more dense materials. Also, since there are technological limitations for processing - identification, separation and reprocessing, the value of the waste materials is low. RIS (confidential) sources indicated costs as high as $1200 per tonne for handling polystyrene. The costs would vary greatly among haulers and recyclers depending on their specific operations and programs. For this analysis, a cost of handling mixed plastic wastes has been assumed at $280 per tonne. This is not considered an accurate estimate but is intended as a preliminary estimate to represent the higher range of costs associated with handling mixed plastics.

Food and Yard Waste

- The cost of diverting food and yard waste has been based on a tipping fee of $75 per tonne at Scotts Farm (prior to temporarily ceasing operations). With an estimated collection cost of $50 per tonne, the cost of diverting food and yard wastes has been assumed to be $125 per tonne.

Wood

- One recycler (confidential source) quoted between $50 per tonne for handling clean recyclable wood and $75 per tonne for handling contaminated and mixed wood wastes, as representative costs. With the assumed collection cost of $50 per tonne the cost for wood recycling for this analysis has been assumed to be $125 per tonne.

C&D (Construction and Demolition)

- The assumed cost of handling C&D materials has been based on a tipping fee of $75 per tonne for relatively clean source separated C&D wastes, such as wood, drywall, steel, rubble, etc. For mixed C&D wastes that require a higher degree of processing, the tipping fee has been assumed to be higher at $85 per tonne. With the assumed collection cost of $50 per tonne, the handling costs for C&D materials has been assumed to be $125 per tonne and $135 per tonne for relatively clean source separated materials and for mixed C&D wastes respectively.

Mixed Wastes

- WMI (Recycle Canada) operates a mixed waste processing facility in Etobicoke that accepts various mixed waste streams from IC&I generators. The tipping fee at this facility has been $115 per tonne (Recycle Canada, 1993). This has been used as the basis for an initial estimate of a cost representative of the type of mixed waste handling which may be a significant component of the No Unprocessed Waste to Landfill System presented in this study. With the assumed collection cost of $50 per tonne, the cost for mixed waste handling has been assumed to be $165 per tonne. This cost includes the cost of disposal of residues.

- System 6, No Unprocessed Waste to Landfill, is built on System 2, Existing Committed. For the purposes of this analysis, it has been assumed that all waste materials assumed to be source separated and diverted under the Existing/Committed System would also be source separated under System 6. As a preliminary estimate, it has been assumed that all remaining wastes (except for wet organics, which would be source separated) would be collected and processed as mixed waste. The cost of handling these materials has been assumed to be $165/tonne. The cost of handling all source separated wet organics would be $125/tonne as for other systems.

- Under System 6, all of the material not diverted under existing/committed policy (System 2) has been assumed to be processed for further recovery of recyclables before disposal in landfill. Therefore, all garbage has been assumed to be collected as mixed waste, at the mixed waste handling cost of $165/tonne. Garbage may be handled in a number of ways under such a system, some of which may result in lower costs.

- For the purposes of this preliminary analysis, the case of 20% capture under the existing/committed policy has been assumed for analysis of System 6 (No Unprocessed Waste to Landfill).

- The costs of handling the "other waste" stream have been assumed to be the same as for handling mixed waste in a mixed waste facility, at $165/tonne.

Disposal Costs

- At the early stages of this study the tipping fees at GTA landfills were at $150 per tonne. During the course of the study these tipping fees have fallen to approximately $80 to $90 per tonne. For this preliminary analysis, a disposal cost has been assumed based on a tipping fee of $85 per tonne at GTA landfills (average of $80 and $90/tonne). Combined with the assumed collection cost of $50 per tonne, a disposal cost of $135 has been used for this analysis.

It should be noted that it has been assumed that different costs exist for different types of materials within the same material category (e.g. high volume, homogeneous scrap metals, dispersed low volume scrap metals and food and beverage containers collected with other wastes). Also there may be different costs for different collection methods for materials within the same category. As described above, preliminary assumptions have been made concerning the relative quantities of the different materials diverted or on the quantities diverted under the different collection methods. The assumed allocations have been held constant for all systems and diversion rates.

4.3 Cost Estimates for IC&I Waste Management Systems

Tables 4.3 through 4.8 present the quantities of each material diverted, the unit diversion and disposal costs used, and the associated cost for diversion and disposal of each material for the six IC&I systems evaluated in the GTA 3Rs analysis. As discussed in Chapter 6 of the Technical Appendix for Service, theoretical estimates of waste generation for 1992 (based on available GTA employment data) and theoretical diversion estimates for 1992 have been used

Table 4.3

Summary of Estimated Costs for IC&I Existing System GTA

Material	Unit Cost (collection & processing - net revenue)	System 1 Existing System	
		Estimated Diversion (tonnes)	Estimated Cost ($)
OCC	$90	214,009	$19,260,794
Fine Paper	$97	165,304	$16,034,502
Mixed Paper	$105	95,795	$10,058,480
Cont Glass	$140	12,279	$1,719,108
Plate Glass	$140	1,364	$191,012
Mixed Cont - Metal	$140	18,474	$2,586,396
Scrap Metals	$120	30,790	$3,694,852
High Volume Scrap Metals	$0	12,316	$0
PET and HDPE	$140	1,828	$255,987
Mixed Plastic Cont	$140	2,139	$299,443
Mixed Scrap Plastics	$280	6,951	$1,946,379
High Vol. Mixed Scrap Plastics	$0	1,604	$0
Food & Yard	$125	2,212	$276,480
Wood	$125	113,579	$14,197,357
Const & Demo Recyclables	$125	200,840	$25,105,013
Const & Demo Other	$135	12,179	$1,644,172
Other	$165	19,977	$3,296,212
Mixed Waste	$165		$0
Disposal (note 2)	$135	1,973,673	$266,445,825
Total Diversion System Cost		911,642	$100,566,186
Total System Cost		2,885,315	$367,012,011

Notes:

1. Costs represent best estimates from information from discussions and work with private haulers and processors in GTA
2. A cost of $50/tonne was used for collection of most materials in GTA, with disposal at $85/tonne, for a total collection cost of $135/tonne
3. Materials such as metal, glass and plastic food and beverage containers are frequently collected together: the same costs for collection and processing have been used for these materials

Table 4.4

Summary of Estimated Costs for IC&I Existing/Committed System GTA

Material	Unit Cost (collection & processing - net revenue)	System 2 Existing/Committed System					
		Estimated Diversion 20% capture (tonnes)	Estimated Cost ($)	Estimated Diversion 40% capture (tonnes)	Estimated Cost ($)	Estimated Diversion 60% capture (tonnes)	Estimated Cost ($)
OCC	$90	214,009	$19,260,794	214,009	$19,260,794	230,927	$20,783,428
Fine Paper	$97	165,304	$16,034,502	165,304	$16,034,502	165,304	$16,034,502
Mixed Paper	$105	104,552	$10,977,966	140,354	$14,737,155	176,156	$18,496,344
Cont Glass	$140	15,207	$2,128,914	28,000	$3,920,013	40,987	$5,738,193
Plate Glass	$140	1,690	$236,546	3,111	$435,557	4,554	$637,577
Mixed Cont - Metal	$140	19,639	$2,749,478	35,589	$4,982,410	51,797	$7,251,569
Scrap Metals	$120	32,732	$3,927,826	59,314	$7,117,729	86,328	$10,359,385
High Volume Scrap Metals	$0	13,093	$0	23,726	$0	34,531	$0
PET and HDPE	$140	16,862	$2,360,732	17,189	$2,406,456	17,677	$2,474,836
Mixed Plastic Cont	$140	2,953	$413,365	5,691	$796,786	8,430	$1,180,207
Mixed Scrap Plastics	$280	9,596	$2,686,873	18,497	$5,179,108	27,398	$7,671,343
High Vol. Mixed Scrap Plastics	$0	2,214	$0	4,268	$0	6,323	$0
Food & Yard	$125	2,212	$276,480	2,212	$276,480	2,212	$276,480
Wood	$125	113,579	$14,197,357	113,579	$14,197,357	122,809	$15,351,153
Const & Demo Recyclables	$125	200,840	$25,105,013	217,730	$27,216,309	290,957	$36,369,634
Const & Demo Other	$135	12,179	$1,644,172	12,179	$1,644,172	12,179	$1,644,172
Other	$165	39,950	$6,591,750	39,950	$6,591,750	39,950	$6,591,750
Mixed Waste	$165		$0		$0		$0
Disposal (note 2)	$135	1,918,705	$259,025,166	1,784,612	$240,922,681	1,566,796	$211,517,447
Total Diversion System Cost		966,610	$108,591,769	1,100,703	$124,796,578	1,318,519	$150,860,573
Total System Cost		2,885,315	$367,616,934	2,885,315	365,719,259	2,885,315	$362,378,020

Notes:

1. Costs represent best estimates from information from discussions and work with private haulers and processors in GTA
2. A cost of $50/tonne was used for collection of most materials in GTA, with disposal at $85/tonne for a total collection cost of $135/tonne
3. Materials such as metal, glass and plastic food and beverage containers are frequently collected together, the same costs for collection and processing have been used for these materials

Table 4.5
Summary of Estimated Costs for IC&I Extended 3Rs System GTA

Material	Unit Cost (collection & processing - net revenue)	System 3 Extended 3Rs System	
		Estimated Diversion (tonnes)	Estimated Cost ($)
OCC	$90	303,179	$27,286,125
Fine Paper	$97	177,977	$17,263,814
Mixed Paper	$105	160,335	$16,835,168
Cont Glass	$140	57,986	$8,118,008
Plate Glass	$140	6,443	$902,001
Mixed Cont - Metal	$140	78,516	$10,992,185
Scrap Metals	$120	130,859	$15,703,121
High Volume Scrap Metals	$0	52,344	$0
PET and HDPE	$140	23,401	$3,276,196
Mixed Plastic Cont	$140	15,098	$2,113,778
Mixed Scrap Plastics	$280	49,070	$13,739,558
High Vol. Mixed Scrap Plastics	$0	11,324	$0
Food & Yard	$125	2,212	$276,480
Wood	$125	144,119	$18,014,825
Const & Demo Recyclables	$125	311,213	$38,901,631
Const & Demo Other	$135	12,179	$1,644,172
Other	$165	39,950	$6,591,750
Mixed Waste	$165		$0
Disposal (note 2)	$135	1,309,110	$176,729,882
Total Diversion System Cost		1,576,205	$181,658,811
Total System Cost		2,885,315	$358,388,693

Notes:

1. Costs represent best estimates from information from discussions and work with private haulers and processors in GTA
2. A cost of $50/tonne was used for collection of most materials in GTA, with disposal at $85/tonne, for a total collection cost of $135/tonne
3. Materials such as metal, glass and plastic food and beverage containers are frequently collected together: the same costs for collection and processing have been used for these materials
4. Data from 20% participation in NAPP case used

Table 4.6

Summary of Estimated Costs for IC&I Expanded 3Rs System GTA

Material	Unit Cost (collection & processing - net revenue)	System 4 Expanded 3Rs System	
		Estimated Diversion (tonnes)	Estimated Cost ($)
OCC	$90	303,179	$27,286,125
Fine Paper	$97	177,977	$17,263,814
Mixed Paper	$105	361,861	$38,310,421
Cont Glass	$140	57,986	$8,118,008
Plate Glass	$140	6,443	$902,001
Mixed Cont - Metal	$140	78,516	$10,992,185
Scrap Metals	$120	130,859	$15,703,121
High Volume Scrap Metals	$0	52,344	$0
PET and HDPE	$140	29,396	$4,115,393
Mixed Plastic Cont	$140	23,946	$3,352,504
Mixed Scrap Plastics	$280	77,826	$21,791,276
High Vol. Mixed Scrap Plastics	$0	17,960	$0
Food & Yard	$125	2,212	$276,480
Wood	$125	154,167	$19,308,405
Const & Demo Recyclables	$125	311,213	$38,901,631
Const & Demo Other	$135	12,179	$1,644,172
Other	$165	39,950	$6,591,750
Mixed Waste	$165		$0
Disposal (note 2)	$135	1,044,001	$140,940,120
Total Diversion System Cost		1,841,314	$214,557,287
Total System Cost		2,885,315	$355,497,407

Notes

1 Costs represent best estimates from information from discussions and work with private haulers and processors in GTA

2 A cost of $50/tonne was used for collection of most materials in GTA, with disposal at $85/tonne, for a total collection cost of $135/tonne

3 Materials such as metal, glass and plastic food and beverage containers are frequently collected together the same costs for collection and processing have been used for these materials

Table 4.7

Summary of Estimated Costs for IC&I Expanded 3Rs with Organics System GTA

Material	Unit Cost (collection & processing - net revenue)	System 5 Expanded 3Rs With Organics	
		Estimated Diversion (tonnes)	Estimated Cost ($)
OCC	$90	303,179	$27,286,125
Fine Paper	$97	177,977	$17,263,814
Mixed Paper	$105	364,861	$38,310,421
Cont Glass	$140	57,986	$8,118,008
Plate Glass	$140	6,443	$902,001
Mixed Cont - Metal	$140	78,516	$10,992,185
Scrap Metals	$120	130,859	$15,703,121
High Volume Scrap Metals	$0	52,344	$0
PET and HDPE	$140	29,396	$4,115,393
Mixed Plastic Cont	$140	23,946	$3,352,504
Mixed Scrap Plastics	$280	77,826	$21,791,276
High Vol. Mixed Scrap Plastics	$0	17,960	$0
Food & Yard	$125	188,007	$23,500,836
Wood	$125	154,467	$19,308,405
Const & Demo Recyclables	$125	311,213	$38,901,631
Const & Demo Other	$135	12,179	$1,644,172
Other	$165	39,950	$6,591,750
Mixed Waste	$165		$0
Disposal (note 2)	$135	858,206	$115,857,815
Total Diversion System Cost		2,027,109	$237,781,643
Total System Cost		2,885,315	$353,639,459

Notes:

1. Costs represent best estimates from information from discussions and work with private haulers and processors in GTA
2. A cost of $50/tonne was used for collection of most materials in GTA, with disposal at $85/tonne, for a total collection cost of $135/tonne
3. Materials such as metal, glass and plastic food and beverage containers are frequently collected together: the same costs for collection and processing have been used for these materials

Table 4.8
Summary of Estimated Costs
for IC&I No Unprocessed Waste to Landfill System
GTA

Material	Unit Cost (collection & processing - net revenue)	System 6 No Unprocessed Waste to Landfill	
		Estimated Diversion (tonnes)	Estimated Cost ($)
OCC	$90	214,009	$19,260,794
Fine Paper	$97	165,304	$16,034,502
Mixed Paper	$105	104,552	$10,977,966
Cont Glass	$140	15,207	$2,128,914
Plate Glass	$140	1,690	$236,546
Mixed Cont - Metal	$140	19,639	$2,749,478
Scrap Metals	$120	32,732	$3,927,826
High Volume Scrap Metals	$0	13,093	$0
PET and HDPE	$140	16,862	$2,360,732
Mixed Plastic Cont	$140	2,953	$413,365
Mixed Scrap Plastics	$280	9,596	$2,686,873
High Vol. Mixed Scrap Plastics	$0	2,214	$0
Food & Yard	$125	166,441	$20,805,152
Wood	$125	113,579	$14,197,357
Const & Demo Recyclables	$125	200,840	$25,105,013
Const & Demo Other	$135	12,179	$1,644,172
Other	$165	39,950	$6,591,750
Mixed Waste	$165	1,754,476	$289,488,467
Disposal (note 2)	$135		$0
Total Diversion System Cost		2,268,102	$418,608,907
Total System Cost		2,885,315	$418,608,907

Notes

1. Costs represent best estimates from information from discussions and work with private haulers and processors in GTA
2. A cost of $50/tonne was used for collection of most materials in GTA, with disposal at $85/tonne, for a total collection cost of $135/tonne
3. Materials such as metal, glass and plastic food and beverage containers are frequently collected together, the same costs for collection and processing have been used for these materials
4. Mixed waste assumed to be garbage and dry recyclables collected together. Cost includes also cost of disposal of residues
5. Data assuming 20% capture under existing/committed policy is shown

for illustrative purposes, and to determine the comparative costs of the different systems. Table 4.9 summarizes the diversion and costs for each system.

The tables show that there is very little difference in the total system cost between the six systems. The estimated total annual system costs (diversion plus disposal) range from approximately $354 million to $419 million, a variation of roughly 16% and not significant considering the level of accuracy in this analysis (±25%). Therefore, the costs for the different systems should be considered essentially the same from this analysis.

The variation in total system costs among the systems is a result of the substitution of different costs of diversion for the cost of disposal at landfill as a result of increased recycling activity. However, the variation is small because the relative differences in the costs of recycling various materials and between recycling and disposing of material are not significant.

Tables 4.3 and 4.4 present the estimated diversion rates and costs of Systems 1 and 2 respectively. The total cost of the Existing System (System 1) is approximately $367 million. For the Existing/Committed System, the total cost is estimated to be in the range of $362 million to $368 million, depending on the effective capture by the 3Rs regulations and the compliance with the 3Rs regulations and NAPP.

The total system cost of System 1 is marginally greater than the total cost of System 2 at the 20% coverage level. This is because the mix of materials diverted is such that the average unit cost of diversion of these materials is greater than the cost of disposal. From System 1 to System 2, increases in the diverted quantities for materials such as plastics, metal containers and "other" wastes which have a relatively high unit diversion cost, are greater than increases in the diverted quantities for materials such as fibres which have a unit diversion cost lower than the disposal cost.

The total cost of the waste management systems decreases marginally moving progressively from System 2 through System 5, from between $362 million to $368 million for System 2 to $354 million for System 5 (Refer to Tables 4.4 through 4.7). This is because the increases in quantities diverted are greater on average for materials with a relatively low unit diversion cost (such as wood, C&D wastes, food and yard wastes), than for materials with a relatively high diversion cost. Therefore the total system cost decreases slightly.

Under System 6, No Unprocessed Waste to Landfill, it has been assumed that all wastes that are not source separated and diverted under the Existing/Committed regulations, would be collected and processed as mixed waste, except for food and yard wastes which would be source separated. The cost of handling (collection plus processing) mixed waste streams has been assumed to be $165

Summary of Estimated Costs of IC&I Systems GTA

System No.	System	Estimated Diversion Rate (%)	Estimated Diversion System Cost ($/tonne diverted)	Estimated Total Diversion System Cost ($)	Estimated Total System Cost ($)
1	Existing	32%	$110	$100,566,186	$367,012,011
2	Existing/Committed (20% Capture)	34%	$112	$108,591,769	$367,616,934
2	Existing/Committed (40% Capture)	38%	$113	$124,796,578	$365,719,259
2	Existing/Committed (60% Capture)	46%	$114	$150,860,573	$362,378,020
3	Extended 3Rs - 90% Cut-off	55%	$115	$181,658,811	$358,388,693
4	Expanded 3Rs	64%	$117	$214,557,287	$355,497,407
5	Expanded 3Rs with Organics	70%	$117	$237,781,643	$353,639,459
6	No Unprocessed Waste to Landfill	79%	$185	$418,608,907	$418,608,907

Notes:

1. Total Diversion System Cost for System 6 includes disposal cost of residues

per tonne, which is higher than the cost of diverting most other materials, and higher than the cost of disposing of waste, (if an $85/tonne tipping fee is assumed). Also, the cost of disposal of garbage and residues from the mixed waste processing facility is included in the mixed waste handling cost. Therefore, the estimated total cost for System 6, ($419 million, refer to Table 4.8) is greater than for other systems (although as discussed already the differences are not significant given the level of accuracy of the analysis.)

Table 4.9 shows that the diversion system costs increase for each System from $100 million/year for System 1 (Existing System) to $419 million/year for System 6 (No Unprocessed Waste to Landfill). This is because greater quantities of materials are diverted by the waste management system. For System 6, the diversion system cost ($419 million/year) is higher relative to other systems because the cost of disposal of residues from mixed waste processing facilities is included as part of the diversion system cost. Therefore the diversion system cost for System 6 is the same as the total system cost for System 6 (refer to Table 4.8).

Similarly, Table 4.9 shows the cost per tonne of material diverted increases marginally from $110 per tonne for System 1 (Existing System) to $117 per tonne for System 5 (Expanded 3Rs with Organics), and then to $185 per tonne for System 6 (No Unprocessed Waste to Landfill). This reflects the relative unit costs for diverting the different waste materials. From the Existing System and the Existing/Committed System through System 6 increasing quantities of materials with higher unit costs of diversion are managed.

4.4 References

Recycling Council of Ontario (RCO). 1992. *Secondary Material Markets Directory.*

Baker, David, WMI - Recycle Canada, 1993, personal communication

Proctor & Redfern, SENES Consultants Ltd., *Solid Waste Environmental Assessment Plan:. Discussion Paper No. 4.3: Waste Composition Study."* June, 1991

National Taskforce on Packaging. Dec., 1992. *National Packaging Protocol: 1988 Benchmark Estimates.*

Rafferty, John, Metro Council Minneapolis-St Paul, Waste Management Div., Personal communication, June, 1993.

Horn, Jim. February 1993. Personal Communications with Jim Horn, Resource Plastics

5.0 GTA 3Rs ANALYSIS - ASSESSMENT AND EVALUATION OF THE 3Rs SYSTEM

5.1 Overview

This section of the report details the net effects analysis process undertaken by the Cost discipline. The six residential and six IC&I systems were compared using a set of established criteria. The relative importance of these criteria were evaluated, weighted and applied to key elements of each system in order to arrive at a hierarchy of highest to lowest-ranked 3Rs systems for each Region in the GTA.

5.2 Net Effects Analysis

5.2.1 Methodology Description

A six step process was conducted to complete the Net Effects Analysis of GTA Residential Systems for the Cost discipline. This included:

1. Completion of a Net Effects Analysis, for cost, of each region, for each of the six residential systems.

2. Completion of a Net Effects Analysis for cost for each of the six IC&I systems for the GTA.

3. Criteria were ranked, according to utility to the analysis and the level of importance of the criteria relative to others.

4. An analysis of systems in each region (for residential systems) and for the GTA (for IC&I systems) based on costs was completed.

Generic Net Effects Tables and region-specific Net Effects Tables for Residential and IC&I systems are presented in Schedules "E" and "F" of this report. Criteria ranking and the comparisons of a alternative systems are described in this chapter.

5.2.2 Residential Cost Criteria

The Cost Criteria Group contains only one criterion, which is the cost per household for the waste management system (diversion and disposal). The indicator was estimated by developing the costs of the waste diversion system and the waste disposal system (in $/year, using 1992 dollars) and dividing the sum of the costs by the total number of households in each Region. The indicator was estimated for all systems using 1992 waste quantity estimates and unit cost

rates. This allows direct comparison of different systems, and it provides a measure of how different diversion systems compare, when all waste management factors are taken into account.

A number of diversion system cost indicators (e.g. cost/hh/year for the diversion system, costs/tonne diverted, etc.) were considered but were found to be of little value for the comparative evaluation unless system costs were considered.

5.2.3 Residential System Criteria Ranking

As discussed above only one criterion, the cost per household for the waste management system (diversion and disposal), was used to rank the systems according to the Cost criteria group. Therefore, no ranking of criteria was necessary.

5.2.4 Residential System Ranking Approach

As discussed above only one criterion, the cost per household for the waste management system (diversion and disposal), was used to rank the systems according to the Cost criteria group. Therefore, no ranking of criteria was necessary and systems were ranked directly according to this criterion.

5.2.5 IC&I System Cost Criteria

For IC&I Systems, the "Cost" Criteria Group contained two criteria which were applied to of each system in assessing their impacts from the perspective of Cost. Generic Net Effects Tables were created for the IC&I systems for the entire GTA since implementation of the systems would cover the entire GTA. The criteria used in the tables include:

- Cost/tonne diverted;
- Total system cost (diversion plus disposal).

The criteria were different for residential and IC&I systems because of the different nature of the residential and IC&I sectors. Household waste generation, the focus of residential waste management systems is not relevant to the IC&I sector. Also, IC&I establishments, the comparable element of the IC&I sector, do not generate as uniform a range of wastes materials as is generated by the residential sector.

The above two criteria were chosen as valuable indicators of the comparative costs of different waste diversion systems with different costs and performances. A third criterion, diversion system costs, was considered to have limited meaning for the IC&I sector. It was felt that the information was adequately captured using the diversion cost/tonne as an indicator.

Total System Cost measured the combined cost of disposal and diversion systems. Isolated, the separate costs of diversion and disposal would have little value as indicators, since a system which has a low diversion cost, due in part to a low diversion rate, would incur a correspondingly high disposal cost.

Total costs of the waste diversion system are often of limited use in determining comparative efficiencies, therefore an indicator which takes into account the performance of the system is of more value. The cost per tonne diverted measures the efficiency of the waste diversion system, and is often used to compare different approaches to waste management. Differences indicate the relative costs of diverting different materials.

5.2.6 IC&I System Criteria Ranking

The above criteria were ranked according to which was the most and least important in comparing different waste diversion systems. Table 5.1 presents the ranking of criteria for the IC&I systems. The total cost for the waste management system was considered the more important criterion, as it provides a measure of how different diversion systems compare, when all waste management factors are taken into account. If total system costs are not included as an indicator, the financial and cost benefits of the waste diversion systems are not fully considered. Therefore, the analysis would provide an unbalanced view of the likely cost impacts of each of the six IC&I waste diversion systems.

The cost per tonne of the diversion system is considered less important, but it is valuable in comparing the efficiencies of different approaches to waste diversion from a cost point of view. Systems with a very high cost per tonne diverted would be considered less favourable than systems with a low cost per tonne diverted.

5.2.7 IC&I System Ranking Approach

Ranking of IC&I systems was based on system costs. Where systems had similar costs, diversion cost per tonne was used to rank the systems.

5.3 Regional Comparative Evaluations of Residential Systems

This section provides a detailed explanation of the evaluations presented in the Net Effects Tables. For the purposes of Net Effects Assessment, the Residential Systems evaluated were identified as follows:

TABLE 5.1

Greater Toronto Area IC&I Systems
COST CRITERIA RANKING

DISCIPLINE		
Criterion	**Rank Order**	**Rationale**
Diversion Cost per tonne diverted	2	This criterion was ranked lowest. While it attempts to compare particular cost efficiencies of different systems, it does not consider the benefits of diversion compared to decreased disposal. It is a measure of how cost efficiently different systems divert wastes, and distinguishes high cost, inefficient systems.
Total System Cost	1	Total System Cost is ranked highest because it compares the overall cost of different systems, both diversion and disposal, which allows the cost benefits of high diversion systems (with decreased disposal) to be considered.
Total Diversion System Cost		This criterion will increase as diversion increases, and has limited value unless combined with disposal costs to develop system costs. The above two criteria cover off the information also covered by this criterion, and therefore, it is included for information but not ranked.

1. A ranking of "1" represents the criterion considered to be the most important.

System Number	System Name
1	Residential Existing
2	Residential Existing/Committed
3	Direct Cost
4	Expanded Blue Box
5	Wet/Dry
6A	Mixed Waste Processing with Low Quality Finished Compost
6B	Mixed Waste Processing with High Quality Finished Compost

5.3.1 Residential Systems Ranking for Region of Durham

Table 5.2 presents a comparative evaluation of systems and overall system ranking for Region of Durham based on the system cost per household. These were developed using unit rates available prior to an informal meeting with Durham staff on June 11, 1993. (Costs based on the updated rates are presented in Chapter 3, and the systems will be compared based on these costs in the Final EA Input Document). The system ranking is discussed below.

Systems 1 to 5 ranked equally as highest, with system costs (measured as costs/household/year) in the $105 to $112/household/year range at low disposal rates, and in the $132 to $140/household/year range at higher disposal rates. Within the accuracy level of this study, (±25%), the costs within these ranges are considered equal. System 6, mixed waste, was ranked lowest, with overall system costs of $171 to $176/household/year, if the mixed waste system produces high quality compost, and $178 to $193/household/year if the system produces a low quality compost (i.e. greater quantities of material from the mixed waste plant are landfilled due to product quality limitations).

The higher overall costs of this system, whether low quality or high quality compost are produced, are related to the high capital costs involved, and the on-going high operating costs. The mixed waste processing system which produces high quality compost was ranked second lowest, as it is marginally better than the system which produces poor quality compost, from a cost point of view.

Table 5.2 presents the system rankings for the Cost Criteria Grouping which are also summarized as follows:

Highest	System 1 - Existing
	System 2 - Existing/Committed
	System 3 - Direct Cost
	System 4 - Expanded Blue Box
	System 5 - Wet/Dry
Second lowest	System 6B - Mixed Waste Processing (high quality compost)

TABLE 5.2

NET EFFECTS SUMMARY FOR COST RESIDENTIAL SYSTEMS
REGION OF DURHAM

Goal/Criteria Group/Criteria	System 1 Existing	System 2 Existing Committed	System 3 Direct Cost	System 4 Expanded Blue Box	System 5 Wet/Dry	System 6A Mixed Waste Processing (High Quality Compost)	System 6B Mixed Waste Processing (Low Quality Compost)
IMPACT:							
COST	Highest	Highest	Highest	Highest	Highest	Second lowest	Lowest
Cost per household (system)	Second highest due to: • $105 to $140/hh/yr	Second highest due to: • $104 t0 $139/hh/yr	Highest due to: • $106 to $132/hh/yr	Highest due to: • $112 to $135/hh/yr	Highest due to: • $115 to $133/hh/yr	Lowest due to: • $171 to $176/hh/yr	Lowest due to: • $178 to $193/hh/yr

Lowest	System 6A - Mixed Waste Processing (low quality compost)

5.3.2 Residential Systems Ranking for Region of Metro Toronto

Table 5.3 presents a comparative evaluation of systems and overall system ranking for Region of Metro Toronto based on the system cost per household. These were developed using unit rates available prior to an informal meeting with Metro staff on June 21, 1993. (Costs based on revised rates are presented in Chapter 3, and the systems will be compared based on these costs in the Final EA Input Document). The system ranking is discussed below.

Systems 1 to 4 (Existing, Existing/Committed, Direct Cost, Expanded Blue Box) ranked equally as highest, with system costs (measured as cost/household/year) in the $131 to $153/household/year range, if disposal costs of $40/tonne were assumed, and $174 to $180/hh/year if disposal costs of $80/tonne were assumed. Within the accuracy level of this study, (±25%), these costs were considered equal.

System 5 (Wet/Dry) had a larger range of potential costs, due to the uncertainty of three-stream collection costs. At the lower collection cost of $75/tonne, it compared to Systems 1 to 4. At the higher collection cost of $130/tonne, it compared with System 6B (Mixed Waste Processing). For cost ranking, System 5 was presented as two sub-systems, System 5A which has a high collection cost, and was ranked lowest, and System 5B, which has a low collection cost, and was ranked highest.

System 6 (Mixed Waste Processing) was the ranked lowest, with overall system costs of $237 to $244/household/year if the mixed waste system produces a high quality compost, and $247 to $266/household/year if the compost quality is poor (i.e. greater quantities of material from the mixed waste plant are landfilled due to product quality limitations).

Table 5.3 presents the system rankings for the Cost Criteria Grouping which are also summarized as follows:

Highest	System 1 - Existing
	System 2 - Existing/Committed
	System 3 - Direct Cost
	System 4 - Expanded Blue Box
Second lowest	System 5B - Wet/Dry (Low Collection Cost)
	System 5A - Wet/Dry (High Collection Cost)
Lowest	System 6B - Mixed Waste Processing (high quality compost)
	System 6A - Mixed Waste Processing (low quality compost)

TABLE 5.3

NET EFFECTS SUMMARY FOR COST RESIDENTIAL SYSTEMS
METRO TORONTO

Goal/Criteria Group/Criteria	System 1 Existing	System 2 Existing Committed	System 3 Direct Cost	System 4 Expanded Blue Box	System 5A Wet/Dry (high collection cost)	System 5B Wet/Dry (low collection cost)	System 6A Mixed Waste Processing (Low Quality Compost)	System 6B Mixed Waste Processing (High Quality Compost)
IMPACT:								
COST	Highest	Highest	Highest	Highest	Lowest	Highest	Lowest	Lowest
Cost per household (system)	Highest due to: • $131-174/hh/yr	Highest due to: • $132-$174/hh/yr	Highest due to: • $146-$177/hh/yr	Highest due to: • $153-$180/hh/yr	Second highest due to: • $194-214/hh/yr	Second highest due to: • $143-163/hh/yr	Lowest due to: • $247-266/hh/yr	Lowest due to: • $237-244/hh/yr

5.3.3 Residential Systems Ranking for Region of York

Table 5.4 presents a comparative evaluation of systems and overall system ranking for Region of York based on the system cost per household. These were developed using unit rates available from Region of York data. These costs were confirmed during an informal meeting with Region of York staff on June 22, 1993. Updated costs are discussed in Chapter 3, and will be incorporated into the Final EA Input Document. The system ranking is discussed below.

Systems 1 to 4 ranked equally as highest, with system costs (measured as cost/household/year) in the $124 to $128/household/year range, if disposal costs of $40/tonne were assumed, and $147 to $163/hh/year if disposal costs of $80/tonne were assumed. Within the accuracy level of this study, (±25%), these costs were considered equal.

System 5, Wet/Dry, had a larger range of potential costs, due to the uncertainty of three-stream collection costs. At the lower collection cost of $75/tonne, it compared to Systems 1 to 4. At the higher collection cost of $130/tonne, it compared with System 6B. For cost ranking, System 5 was presented as two sub-systems, System 5A which had a high collection cost, and was ranked lowest, and System 5B, which had a low collection cost, and was ranked highest.

System 6, Mixed Waste, was the lowest, with an overall system costs of $205 to $210/household/year, if the mixed waste processing system produces a high quality compost, and $214 to 229/household/year if the compost quality is poor (i.e. greater quantities of material from the mixed waste plant are landfilled due to product quality limitations).

In summary, system ranking for the cost criteria group is as follows:

Highest	System 1 - Existing
	System 2 - Existing/Committed
	System 3 - Direct Cost
	System 4 - Expanded Blue Box
Second lowest	System 5B - Wet/Dry (Low Collection Cost)
	System 5A - Wet/Dry (High Collection Cost)
Lowest	System 6B - Mixed Waste Processing (high quality compost)
	System 6A - Mixed Waste Processing (low quality compost)

5.3.4 Residential Systems Ranking for Region of Peel

Table 5.5 presents a comparative evaluation of systems and overall system ranking for Region of Peel based on the system cost per household. These were developed using unit rates available prior to an informal meeting with Region of Peel waste reduction staff on June 18, 1993. Costs based on updated rates are

TABLE 5.4

NET EFFECTS SUMMARY FOR COST RESIDENTIAL SYSTEMS
REGION OF YORK

Goal/Criteria Group/Criteria	System 1 Existing	System 2 Existing Committed	System 3 Direct Cost	System 4 Expanded Blue Box	System 5A Wet/Dry (high collection cost)	System 5B Wet/Dry (low collection cost)	System 6A Mixed Waste Processing (Low Quality Compost)	System 6B Mixed Waste Processing (High Quality Compost)
IMPACT:								
COST	**Highest**	**Highest**	**Highest**	**Highest**	**Second highest**	**Highest**	**Lowest**	**Lowest**
Cost per household (system)	Highest due to: • $128-163/hh/yr	Highest due to: • $128-163/hh/yr	Highest due to: • $124-148/hh/yr	Highest due to: • $126-147/hh/yr	Second highest due to: • $190-207/hh/yr	Highest due to: • $134-151/hh/yr	Lowest due to: • $214-229/hh/yr	Lowest due to: • $205-210/hh/yr

TABLE 5.5

NET EFFECTS SUMMARY FOR COST RESIDENTIAL SYSTEMS
REGION OF PEEL

Goal/Criteria Group/Criteria	System 1 Existing	System 2 Existing Committed	System 3 Direct Cost	System 4 Expanded Blue Box	System 5 Wet/Dry	System 6A Mixed Waste Processing (Low Quality Compost)	System 6B Mixed Waste Processing (High Quality Compost)
IMPACT:							
COST	**Highest**	**Highest**	**Highest**	**Highest**	**Highest**	**Lowest**	**Lowest**
Cost per household (system)	Highest due to: • $133-$175/hh/yr	Highest due to: • $133-$172/hh/yr	Highest due to: • $136-$165/hh/yr	Highest due to: • $136-$164/hh/yr	Highest due to: • $139-158/hh/yr	Lowest due to: • $251-269/hh/yr	Lowest due to: • $239-245/hh/yr

presented in Chapter 3, and will be incorporated into the analysis presented in the Final EA Input Document. The system ranking is discussed below.

Systems 1 to 5 ranked equally as highest, with system costs (measured as costs/household/year) in the $133 to $139/household/year range, if disposal costs of $40/tonne were assumed, and $158 to $172/hh/year if disposal costs of $80/tonne were assumed. Within the accuracy level of this study, (±25%), these costs are considered equal. System 6, mixed waste, was ranked lowest, with an overall system costs of $239 to $245/household/year, if the mixed waste system produces a high quality compost, and $251 to 269/household/year if the compost quality is poor (i.e. greater quantities of material from the mixed waste plant are landfilled due to product quality limitations).

In summary, system ranking for the cost criteria group is as follows:

Highest	System 1 - Existing
	System 2 - Existing/Committed
	System 3 - Direct Cost
	System 4 - Expanded Blue Box
	System 5 - Wet/Dry
Second lowest	System 6B - Mixed Waste Processing (high quality compost)
Lowest	System 6A - Mixed Waste Processing (low quality compost)

5.3.5 IC&I Systems for the GTA

This section provides a detailed explanation of the evaluations presented in the Net Effects Tables. For the purposes of Net Effects Assessment, the IC&I Systems evaluated were identified as follows:

System Number	System Name
1	IC&I Existing
2	IC&I Existing/Committed
3	Extended 3Rs Regulations
4	Expanded 3Rs Regulations
5	Expanded 3Rs Regulations with Organics
6	No Unprocessed Waste to Landfill

Table 5.6 presents a comparative evaluation of GTA IC&I Systems and summarizes system ranking by cost criterion, and overall system ranking for the GTA. The system ranking is discussed below for the two cost criteria used for systems evaluation. Overall system ranking for cost is discussed at the end of this section.

Table 5.6

NET EFFECTS SUMMARY FOR COST IC&I SYSTEMS
GREATER TORONTO AREA

Goal/Criteria Group/Criteria	ICI System 1 Existing	ICI System 2 Existing/ Committed	ICI System 3 Extended 3Rs Regulations	ICI System 4 Expanded 3Rs Regulations	ICI System 5 Expanded 3Rs Regulations with Organics	ICI System 6 No Unprocessed Waste to Landfill
IMPACT:						
Cost	Highest	Highest	Highest	Highest	Highest	Highest
Diversion Cost ($ per tonne diverted)	Highest due to: • $110/tonne	Highest due to: • $112 to $114tonne	Highest due to: • $115/tonne	Highest due to: • $117/tonne	Highest due to: • $117/tonne	Lowest due to: • $185/tonne
Total System Cost ($/year)	Highest due to: • $367million	Highest due to: • $362-$368million	Highest due to: • $358million	Highest due to: • $355million	Highest due to: • $354million	Highest due to: • $419million

Total Waste Management System Cost

The total system costs of systems 1 through 6 vary from $354 million to $419 million per year. Within the accuracy of these calculations (considered to be ±25%), the costs of Systems 1 to 6 are considered to be the same. Thus, Systems 1 through 6 were all ranked highest.

It should be stressed that costs for all systems were developed using estimated costs and prices for recycling and disposing of different materials obtained through discussion with GTA recyclers, and general IC&I waste collection and disposal rates obtained through discussions with haulers. These were considered less reliable than the cost data used for the residential systems (which were obtained from municipal budget data), and are likely to change as economic factors change. As an example, the tipping fee for IC&I waste dropped from $150/tonne, to $80-$90/tonne during the course of this study. This had a significant impact on estimated costs. For this reason, these costs should be considered of value only for comparative purposes.

Cost per tonne diverted.

For the indicator cost per tonne diverted, there is very little difference between Systems 1, 2, 3, 4, and 5. The costs per tonne diverted for these five systems range from $110/tonne to $117/tonne. Within the accuracy of these calculations, these are considered virtually the same. All of these systems were therefore ranked as highest.

System 6 has the highest cost per tonne diverted of all six systems, at $185/tonne, and was therefore ranked lowest. It should be noted that if there is a high degree of source separation achieved within this system it is expected that the cost would decrease.

Overall System Ranking for Cost

In overall system ranking, total waste management system cost was considered the most important criterion, while the cost per tonne diverted was used to differentiate between systems, if necessary. On this basis, Systems 1 through 6 were ranked as highest, due to similar overall system costs.

5.4 Summary of Findings

Results of the Net Effects Analysis process show considerable consistency among the regions with respect to the highest and lowest ranked systems for diversion of residential waste in the Cost discipline. For each of Durham, Metro, Peel and York, the Existing System, Existing/Committed System, the Direct Cost System and the Expanded Blue Box System were ranked highest with respect to Cost.

For each region, Systems 6A and 6B - Mixed Waste Processing (low and high quality finished product) were ranked lowest.

For Durham and Peel Regions, System 5 (Wet/Dry)was also ranked highest, based on an assumed (lower) Wet/Dry collection cost of $75/tonne. Wet/Dry system costs were not evaluated for these regions using the higher rate of $130/tonne because of time constraints. In Metro Toronto and York Regions, two Wet/Dry Systems were evaluated. System 5B (Wet/Dry with low collection cost) was ranked second lowest, whereas System 5A (Wet/Dry with a high collection cost) was ranked lowest.

The six GTA IC&I Systems were considered to be the same with respect to cost, and all were ranked equally at highest in terms of Cost.

SCHEDULE A

REGION OF DURHAM ESTIMATES

Backyard Composted Diversion @ 240 kg/hh

Original Unit Cost and Cost Estimates
Region of Durham (Low Disposal Rate)

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Blue Box Net	Yard Waste Collection	Yard Waste Processing	Yard Waste Net	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection
Unit Cost	($/t)	$92	$110	$22	$180	$74	$55	$129	$25	$100	$60	$40	$150	$75
Existing	tonnes	19,857	19,857	19,857	19,857	8,045	8,045	8,045	5,388	3,451	103,091	103,091		
	cost ($)	$1,826,844	$2,184,270	$436,854	$3,574,260	$595,330	$442,475	$1,037,805	$134,700	$345,100	$6,185,460	$4,123,640		
Existing/	tonnes	19,857	19,857	19,857	19,857	8,045	8,045	8,045	6,348	3,451	102,131	102,131		
Committed	cost($)	$1,826,844	$2,184,270	$436,854	$3,574,260	$595,330	$442,475	$1,037,805	$158,700	$345,100	$6,127,860	$4,085,240		
User Pay	tonnes	32,124	32,124	32,124	32,124	12,269	12,269	12,269	19,502	3,451	74,326	74,326		
	cost ($)	$2,955,408	$3,533,640	$706,728	$5,782,320	$907,906	$674,795	$1,582,701	$487,550	$345,100	$4,459,560	$2,973,040		
Expanded	tonnes	44,075	44,075	44,075	44,075	8,045	8,045	8,045	19,502	3,451	66,598	66,598		
Blue Box	cost ($)	$4,054,900	$4,848,250	$969,650	$7,933,500	$595,330	$442,475	$1,037,805	$487,550	$345,100	$3,995,880	$2,663,920		
Wet/Dry	tonnes		44,075	44,075			23,979	23,979	19,502	3,451		50,664		118,718
	cost ($)		$4,848,250	$969,650			$1,318,845	$3,093,291	$487,550	$345,100		$2,026,560		$8,903,850
Mixed Waste	tonnes	19,857	19,857	19,857	19,857	8,045	8,045	8,045	19,502	3,451	88,977		88,977	
Processing	cost ($)	$1,826,844	$2,184,270	$436,854	$3,574,260	$595,330	$442,475	$1,037,805	$487,550	$345,100	$5,338,620		$13,346,550	
- if compost	tonnes											45,000		
landfilled	cost ($)											$1,800,000		
- if compost	tonnes											17,000		
marketed	cost ($)											$680,000		

Backyard Composters Diver 240 kg/yr

Summary of Original Residential System Costs (Low Disposal Rate)
Region of Durham

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Costs	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	27	$2,422,174	$2,669,691	$5,091,865	$6,185,460	$4,123,640	$10,309,100	$15,400,965	$139	$35	$105
2	Existing/ Committed	28	$2,422,174	$2,693,691	$5,115,865	$6,127,860	$4,085,240	$10,213,100	$15,328,965	$136	$35	$104
3	User Pay	48	$3,863,314	$4,334,357	$8,197,671	$4,459,560	$2,973,040	$7,432,600	$15,630,271	$122	$56	$106
4	Expanded Blue Box	53	$4,650,230	$5,153,725	$9,803,955	$3,995,880	$2,663,920	$6,659,800	$16,463,755	$131	$67	$112
5	Wet/Dry	64	$5,104,050	$6,030,095	$11,134,145	$3,799,800	$2,026,560	$5,826,360	$16,960,505	$122	$76	$115
6	Mixed Waste Processing	69-92	$2,422,174	$3,022,541	$19,067,265	$5,338,620	$680,000 to $1,800,000	$6,018,620 to $7,138,620	$25,085,885 to $26,205,885	$155 $201	$130	$171
			MSW Processing	$13,622,550								

Scenario 2: Garbage disposal at $40/tonne

Garbage Disposal @ $35/tonne
Backyard composter diversion @ 240 kg/yr

Table A.3
Updated Unit Costs and Cost Estimates
Region of Durham

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	Backyard Composting Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	High Wet/Dry Collection	Low Wet/Dry Collection	Wet Composting
Unit Cost	($/t)	$103	$162	$26	$78	$88	$25	$188	$45	$35	$135	$130	$75	$60
Existing	tonnes	19,857	19,857	19,857	8,045	8,045	5,388	5,291	103,091	103,091				
	cost ($)	$2,045,271	$3,216,834	$516,282	$627,510	$707,960	$134,700	$994,708	$4,639,095	$3,608,185				
Existing/ Committed	tonnes	19,857	19,857	19,857	8,045	8,045	6,348	5,291	102,131	102,131				
	cost($)	$2,045,271	$3,216,834	$516,282	$627,510	$707,960	$158,700	$994,708	$4,595,895	$3,574,585				
Direct Cost	tonnes	30,674	30,674	30,674	9,987	9,987	22,759	5,291	72,961	72,961				
	cost ($)	$3,159,422	$4,969,188	$797,524	$778,986	$878,856	$568,975	$994,708	$3,283,245	$2,553,635				
Expanded Blue Box	tonnes	42,788	42,788	42,788	8,045	8,045	22,759	5,291	62,794	62,794				
	cost ($)	$4,407,164	$6,931,656	$1,112,488	$627,510	$707,960	$568,975	$994,708	$2,825,730	$2,197,790				
Wet/Dry	tonnes		42,788	42,788		9,987	22,759	5,291		51,014		19,820	19,820	9,833
	cost ($)		$6,931,656	$1,112,488		$878,856	$568,975	$994,708		$1,785,490		$2,576,600	$1,486,500	$589,980
Mixed Waste Processing	tonnes	19,857	19,857	19,857	8,045	8,045	22,759	5,291	85,721		85,721			
	cost ($)	$2,045,271	$3,216,834	$516,282	$627,510	$707,960	$568,975	$994,708	$3,857,445		$11,572,335			
- compost landfilled	tonnes									52,315				
	cost ($)									$1,831,030				
- compost marketed	tonnes									30,405				
	cost ($)									$1,064,179				

Notes:
- Blue Box collection costs based on 1992 costs $1,767,000 to collect 17,166 tonnes (excluding Igloos) (Watson, Region of Durham, 1993)
- Blue Box Processing cost based on 1992 cost of $3.4 million to process 21,000 tonnes (Watson, Region of Durham, 1993)
- Blue Box Revenue based on $543,000 for sale of 21,000 tonnes of materials at the Durham MRF in 1992 (Watson, Region of Durham, 1993)
- Yard Waste collection cost based on average collection costs for Whitby, Newcastle and Ajax (Gale, Town of Whitby [date] (O'Leary, BFI Oshawa, 1993)
- Yard Waste processing based on 1992 contracted price of $88/tonne (Watson, Region of Durham1993)
- Other Waste Diverted cost based on $75,000/400 tonnes ($188/tonne - from Oshawa transfer station in Durham,1993)
- Garbage Collection cost based on average cost for Pickering, Ajax, and Newcastle (O'Leary, BFI Oshawa, 1993)
- Garbage Disposal cost based on Durham rate of $90/tonne currently being negotiated between Metro and Durham (Source: Future Urban Research, 1993). Low disposal rate is assumed for sensitivity
- Wet Composting cost based on Hensall for in-vessel (Jacob, 1993)
- High Wet/Dry Collection cost based on Markham Wet/Dry study (including bins) - $130/tonne (LURA Group, 1993)
- Low Wet/Dry Collection cost is estimated to be $60/tonne, plus $15/tonne for purchase of bins, for a total of $75/tonne (RIS estimate)

Garbage Disposal @ $35/tonne
Backyard composter diversion @ 240 kg/yr

Table A.4

Summary of Updated Residential System Costs
Region of Durham

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	27	$2,672,781	$4,537,920	$7,210,701	$4,639,095	$3,608,185	$8,247,280	$15,457,981	$187	$49	$105
2	Existing/ Committed	28	$2,672,781	$4,561,920	$7,234,701	$4,595,895	$3,574,585	$8,170,480	$15,405,181	$183	$49	$105
3	Direct Cost	48	$3,938,408	$6,614,203	$10,552,611	$3,283,245	$2,553,635	$5,836,880	$16,389,491	$154	$72	$111
4	Expanded Blue Box	56	$5,034,674	$8,090,811	$13,125,485	$2,825,730	$2,197,790	$5,023,520	$18,149,005	$166	$89	$123
5A	Wet/Dry (H)	64	$8,139,040	$8,851,687	$16,990,727	$6,631,820	$1,785,490	$8,417,310	$25,408,037	$187	$116	$173
5B	Wet/Dry (L)	64	$4,695,600	$8,851,687	$13,547,287	$3,826,050	$1,785,490	$5,611,540	$19,158,827	$149	$92	$130
6	Mixed Waste Processing	70-88	$2,672,781	$4,972,195	$19,217,311	$3,857,445	$1,831,030 to $1,064,179	$5,688,475 to $4,921,624	$24,905,786 to $24,138,935	$173 $215	$131	$169 $164
			MSW Processing	$11,572,335								

No. of Households = 147,105

Notes:
- (H) - Based on Wet/Dry Collection cost of $130/tonne
- (L) - Based on Wet/Dry Collection cost of $75/tonne
- Garbage Disposal at $90/tonne

SCHEDULE B

METRO TORONTO ESTIMATES

Garbage Disposal @ $37/tonne
Backyard Composters Divert 240 kg/yr

Table B.1

Original Unit Costs and Cost Estimates (Low Disposal Rate)
Metropolitan Toronto

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection	Wet/Dry Collection
Unit Cost	($/t)	$130	$69	$12	$74	$55	$25	$100	$60	$37	$150	$75	$130
Existing	tonnes	106,145	106,145	106,145	71,062	71,062	25,200	6,225	868,613	868,613			
	cost ($)	$13,798,850	$7,324,005	$1,273,740	$5,258,588	$3,908,410	$630,000	$622,500	$52,116,780	$32,138,681			
Existing/	tonnes	116,536	116,536	116,536	74,800	74,800	29,400	6,114	850,395	850,395			
Committed	cost($)	$15,149,680	$8,040,984	$1,398,432	$5,535,200	$4,114,000	$735,000	$611,400	$51,023,700	$31,464,615			
Direct Cost	tonnes	288,020	288,020	288,020	74,800	74,800	81,221	6,114	627,090	627,090			
	cost ($)	$37,442,600	$19,873,380	$3,456,240	$5,535,200	$4,114,000	$2,030,525	$611,400	$37,625,400	$23,202,330			
Expanded	tonnes	355,806	355,806	355,806	74,800	74,800	81,221	6,114	559,303	559,303			
Blue Box	cost ($)	$46,254,780	$24,550,614	$4,269,672	$5,535,200	$4,114,000	$2,030,525	$611,400	$33,558,180	$20,694,211			
Wet/Dry	tonnes		355,806	355,806		221,708	81,221	6,114		412,396		989,910	989,910
	cost ($)		$24,550,614	$4,269,672		$12,193,940	$2,030,525	$611,400		$15,258,652		$74,243,250	$128,688,300
Mixed Waste	tonnes	116,536	116,536	203,990	74,800	74,800	81,221	6,114	798,574		798,574		
Processing	cost ($)	$15,149,680	$8,040,984	$2,447,880	$5,535,200	$4,114,000	$2,030,525	$611,400	$47,914,440		$119,786,100		
- compost	tonnes									150,095			
landfilled	cost ($)									$5,553,515			
- compost	tonnes									386,881			
marketed	cost ($)									$14,314,597			

Notes:
1. See Service Technical Appendix for derivation of tonnes managed by different system components
2. See Tables 3.7 and 3.8 for updated costs and diversion estimates

Garbage Disposal @ $37/tonne
Backyard Composters Divert 240 kg/yr

Table B.2

Summary of Original Residential System Costs (Low Disposal Rate)
Metropolitan Toronto

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	19	$19,057,438	$11,211,175	$30,268,613	$52,116,780	$32,138,681	$84,255,461	$114,524,074	$145	$35	$174
2	Existing/ Committed	21	$20,684,880	$12,102,952	$32,787,832	$51,023,700	$31,464,615	$82,488,315	$115,276,147	$145	$38	$174
3	Direct Cost	42	$42,977,800	$23,173,065	$66,150,865	$37,625,400	$23,202,330	$60,827,730	$126,978,595	$149	$76	$177
4	Expanded Blue Box	48	$51,789,980	$27,036,867	$78,826,847	$33,558,180	$20,694,211	$54,252,391	$133,079,238	$152	$90	$180
5	Wet/Dry (L) Wet/Dry (H)	62 62	$43,313,550 $75,076,820	$35,116,807 $35,116,807	$78,430,357 $110,193,627	$30,929,700 $53,611,480	$15,258,652 $15,258,652	$46,188,352 $68,870,132	$124,618,709 $179,063,759	$118 $166	$90 $126	$143 $205
6	Mixed Waste Processing	64-86	$20,684,880 MSW Processing $119,786,100	$12,349,029	$152,820,009	$47,914,440	$5,553,515 to $14,314,597	$53,467,955 to $62,229,037	$206,287,964 to $215,049,046	$165 $221	$175 $175	$237 $247

No. of Households = 872,162

Notes:

1 Refer to Table 3.5 for derivation of costs

2. Refer to Service Technical Appendix for derivation of diversion estimates

3 System costs divided by 872,162 households in Metro Toronto in 1992.

rbage Disposal @ $37/tonne
ckyard Composters Divert 240 kg/yr

Table B.2

Summary of Original Residential System Costs (Low Disposal Rate)
Metropolitan Toronto

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	19	$19,057,438	$11,211,175	$30,268,613	$52,116,780	$32,138,681	$84,255,461	$114,524,074	$145	$35	$174
2	Existing/ Committed	21	$20,684,880	$12,102,952	$32,787,832	$51,023,700	$31,464,615	$82,488,315	$115,276,147	$145	$38	$174
3	Direct Cost	42	$42,977,800	$23,173,065	$66,150,865	$37,625,400	$23,202,330	$60,827,730	$126,978,595	$149	$76	$177
4	Expanded Blue Box	48	$51,789,980	$27,036,867	$78,826,847	$33,558,180	$20,694,211	$54,252,391	$133,079,238	$152	$90	$180
5	Wet/Dry (L) Wet/Dry (H)	62 62	$43,313,550 $75,076,820	$35,116,807 $35,116,807	$78,430,357 $110,193,627	$53,611,480 $53,611,480	$15,258,652 $15,258,652	$68,870,132 $68,870,132	$147,300,489 $179,063,759	$118 $166	$90 $126	$169 $205
6	Mixed Waste Processing	64-86	$20,684,880	$12,349,029	$152,820,009	$47,914,440	$5,553,515 to $14,314,597	$53,467,955 to $62,229,037	$206,287,964 to $215,049,046	$165 $221	$175 $175	$237 $247
			MSW Processing $119,786,100									

No. of Households = 872,162

Notes:
1. Refer to Table 3.5 for derivation of costs
2. Refer to Service Technical Appendix for derivation of diversion estimates
3. System costs divided by 872,162 households in Metro Toronto in 1992.

Garbage Disposal @ $37/tonne
Backyard composter diversion @ 240 kg/yr

Table B.3
Updated Unit Costs and Cost Estimates
Metropolitan Toronto

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection	Wet/Dry Collection	Wet Composting
Unit Cost	($/t)	$161	$38	$12	$74	$55	$25	$188	$60	$37	$114	$130	$75	$60
Existing	tonnes	106,145	106,145	106,145	71,062	71,062	25,200	6,225	868,613	868,613				
	cost ($)	$17,089,345	$4,033,510	$1,273,740	$5,258,588	$3,908,410	$630,000	$1,170,300	$52,116,780	$32,138,681				
Existing/	tonnes	120,036	120,036	120,036	74,800	74,800	29,400	6,114	846,895	846,895				
Committed	cost($)	$19,325,796	$4,561,368	$1,440,432	$5,535,200	$4,114,000	$735,000	$1,149,432	$50,813,700	$31,335,115				
Direct Cost	tonnes	291,520	291,520	291,520	74,800	74,800	81,221	6,114	623,590	623,590				
	cost ($)	$46,934,720	$11,077,760	$3,498,240	$5,535,200	$4,114,000	$2,030,525	$1,149,432	$37,415,400	$23,072,830				
Expanded	tonnes	355,806	355,806	355,806	74,800	74,800	81,221	6,114	559,303	559,303				
Blue Box	cost ($)	$57,284,766	$13,520,628	$4,269,672	$5,535,200	$4,114,000	$2,030,525	$1,149,432	$33,558,180	$20,694,211				
Wet/Dry	tonnes		355,806	355,806		74,800	81,221	6,114		412,396		989,909	989,909	146,907
	cost ($)		$13,520,628	$4,269,672		$4,114,000	$2,030,525	$1,149,432		$15,258,652		$128,688,170	$74,243,175	$8,814,420
Mixed Waste	tonnes	120,036	120,036	203,990	74,800	74,800	81,221	6,114	795,074		795,074			
Processing	cost ($)	$19,325,796	$4,561,368	$2,447,880	$5,535,200	$4,114,000	$2,030,525	$1,149,432	$47,704,440		$90,638,436			
- compost	tonnes									482,412				
landfilled	cost ($)									$17,849,261				
- compost	tonnes									280,859				
marketed	cost ($)									$10,391,768				

Notes:

- Blue Box costs taken from unpublished 1992 Annual Report. Total Gross Cost of Blue Box program is $199/tonne, split $161/tonne collection, $38/tonne processing
- Blue Box revenue is $12/tonne, taken from unpublished 1992 Annual Report.
- Yard Waste collection cost based on Etobicoke cost of $74/tonne for bagged leaf and yard waste (Ortech International, 1993).
- Yard Waste processing based on $22/tonne capital, $33/tonne operating (for Waterloo, Ontario; Ortech International, 1993)
- Other Waste Diverted cost based on $75,000/400 tonnes ($188/tonne - from Oshawa transfer station in Durham) (Watson, 1993)
- Garbage Collection cost taken from Metropolitan Toronto Commissioner of Works (1992)
- Garbage Disposal cost is assumed
- High Wet/Dry Collection cost based on Markham Wet/Dry study (including bins) - $130/tonne (LURA Group, 1992)
- Low Wet/Dry Collection cost is estimated to be $60/tonne, plus $15/tonne for purchase of bins, for a total of $75/tonne

backyard composter diversion @ 240 kg/yr

Table B.4
Summary of Updated Residential System Costs
Metropolitan Toronto

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	19	$22,347,933	$8,468,480	$30,816,413	$52,116,780	$32,138,681	$84,255,461	$115,071,874	$148	$35	$132
2	Existing/ Committed	21	$24,860,996	$9,119,368	$33,980,364	$50,813,700	$31,335,115	$82,148,815	$116,129,179	$148	$39	$133
3	Direct Cost	42	$52,469,920	$14,873,477	$67,343,397	$37,415,400	$23,072,830	$60,488,230	$127,831,627	$148	$77	$147
4	Expanded Blue Box	48	$62,819,966	$16,544,913	$79,364,879	$33,558,180	$20,694,211	$54,252,391	$133,617,270	$153	$91	$153
5A	Wet/Dry (H)	65	$75,076,690	$25,359,333	$100,436,023	$53,611,480	$15,258,652	$68,870,132	$169,306,155	$151	$115	$194
5B	Wet/Dry (L)	65	$43,313,475	$25,359,333	$68,672,808	$30,929,700	$15,258,652	$46,188,352	$114,861,160	$103	$79	$132
6	Mixed Waste Processing	71-89	$24,860,996	$9,407,445	$124,906,877	$47,704,440	$17,849,261 to $10,391,768	$65,553,701 to $58,096,208	$190,460,578 to $183,003,085	$157 $210	$143	$218 $210
			MSW Processing	$90,638,436								

No. of Households = 872,162

Notes:
- (H) - Based on Wet/Dry Collection cost of $130/tonne
- (L) - Based on Wet/Dry Collection cost of $75/tonne
- Garbage Disposal at $37/tonne

SCHEDULE C

REGION OF YORK ESTIMATES

Backyard Composter Diversion @ 240 kg/composter

Table C.1
Original Unit Costs and Cost Estimates (Low Disposal Rate)
Region of York

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection	Wet/Dry Collection
Unit Cost	($/t)	$76	$87	$33	$66	$35	$25	$188	$60	$37	$150	$75	$130
Existing	tonnes	26,805	26,805	26,805	16,300	16,300	6,972	6,087	142,150	142,150			
	cost ($)	$2,037,180	$2,332,035	$884,565	$1,075,800	$570,500	$174,300	$1,144,356	$8,529,000	$5,259,550			
Existing/ Committed	tonnes	26,805	26,805	26,805	16,300	16,300	6,972	6,087	142,150	142,150			
	cost($)	$2,037,180	$2,332,035	$884,565	$1,075,800	$570,500	$174,300	$1,144,356	$8,529,000	$5,259,550			
User Pay	tonnes	50,965	50,965	50,965	16,300	16,300	26,046	6,087	98,917	98,917			
	cost ($)	$3,873,340	$4,433,955	$1,681,845	$1,075,800	$570,500	$651,150	$1,144,356	$5,935,020	$3,659,929			
Expanded Blue Box	tonnes	62,893	62,893	62,893	16,300	16,300	26,046	6,087	86,988	86,988			
	cost ($)	$4,779,868	$5,471,691	$2,075,469	$1,075,800	$570,500	$651,150	$1,144,356	$5,219,280	$3,218,556			
Wet/Dry	tonnes		62,893	62,893		34,225	26,046	6,087		69,063		166,181	166,181
	cost ($)		$5,471,691	$2,075,469		$1,197,875	$651,150	$1,144,356		$2,555,331		$12,463,575	$21,603,530
Mixed Waste Processing	tonnes	26,805	26,805	41,131	16,300	16,300	26,046	6,087	123,076		123,076		
	cost ($)	$2,037,180	$2,332,035	$1,357,307	$1,075,800	$570,500	$651,150	$1,144,356	$7,384,560	21,229	$18,461,400		
- compost	tonnes									$785,473			
landfilled	cost ($)									57,827			
- compost	tonnes									$2,139,599			
marketed	cost ($)												

Notes:
- Blue Box Collection cost based on $319.011/4196 tonnes ($76/tonne) for Richmond Hill, 1992
- Blue Box processing cost based on $261259/4196 tonnes ($62/t - processing + truck rental) for Richmond Hill. A capital cost of $25/tonne is assumed and added to give $87/tonne
- Yard Waste collection cost based on $129,933/1967 tonnes ($66/tonne) for Richmond Hill, 1992
- Yard Waste processing cost based on $35/tonne for Richmond Hill
- Other Waste Diverted cost based on $75,000/400 tonnes ($188/tonne - from Oshawa transfer station in Durham) (Watson, 1993)
- Garbage Collection cost based on $17.95/capita*45,500 people(1991 census)/13,933 tonnes ($60/tonne - from Newmarket, 1992)
- Garbage Disposal cost is assumed at $80/tonne (same assumption as for Metro Toronto)
- Wet/Dry Collection cost based on Markham Wet/Dry study ($130/tonne - including bins) (LURA Group, 1992)
- See Service Technical Appendix for derivation of diversion estimates
- See tables 3.11 and 3.12 for updated diversion estimates and system costs

Garbage Disposal cost @ $37/tonne
Backyard Composter Diversion @ 240 kg/composter

Table C.2
Summary of Original Residential System Costs (Low Disposal Rate)
Region of York

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	28	$3,112,980	$3,336,626	$6,449,606	$8,529,000	$5,259,550	$13,788,550	$20,238,156	$115	$40	$125
2	Existing/ Committed	28	$3,112,980	$3,336,626	$6,449,606	$8,529,000	$5,259,550	$13,788,550	$20,238,156	$115	$40	$125
3	User Pay	50	$4,949,140	$5,118,116	$10,067,256	$5,935,020	$3,659,929	$9,594,949	$19,662,205	$101	$62	$122
4	Expanded Blue Box	56	$5,855,668	$5,762,228	$11,617,896	$5,219,280	$3,218,556	$8,437,836	$20,055,732	$104	$72	$124
5A	Wet/Dry (L)	62	$7,283,850	$6,389,603	$13,673,453	$5,179,725	$2,555,331	$7,735,056	$21,408,509	$144	$85	$133
5B	Wet/Dry (H)	62	$12,625,340	$6,389,603	$19,014,943	$8,978,190	$2,555,331	$11,533,521	$30,548,464	$200	$118	$189
6	Mixed Waste Processing	64-86	$3,112,980	$3,340,735	$24,915,115	$7,384,560	$785,473 to $2,139,599	$8,170,033 to $9,524,159	$33,085,148 to $34,439,274	$141 to $177	$154	$205 to $213
			MSW Processing	$18,461,400								

No. of Households = 161,556

Notes
1. See Table C.1 for derivation of costs
2. Refer to Service Technical Appendix for diversion estimates
3. System costs divided by 161,556 households in Region of York in 1992

Table C.3
Updated Unit Costs and Cost Estimates
Region of York

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection	Wet/Dry Collection	Wet Composting
Unit Cost	($/t)	$76	$63	$27	$66	$59	$25	$188	$54	$37	$135	$130	$75	$60
Existing	tonnes	26,805	26,805	26,805	16,300	16,300	6,972	6,087	142,150	142,150				
	cost ($)	$2,037,180	$1,688,715	$723,735	$1,075,800	$961,700	$174,300	$1,144,356	$7,676,100	$5,259,550				
Existing/ Committed	tonnes	26,805	26,805	26,805	16,300	16,300	6,972	6,087	142,150	142,150				
	cost($)	$2,037,180	$1,688,715	$723,735	$1,075,800	$961,700	$174,300	$1,144,356	$7,676,100	$5,259,550				
User Pay	tonnes	50,965	50,965	50,965	16,300	16,300	26,046	6,087	98,917	98,917				
	cost ($)	$3,873,340	$3,210,795	$1,376,055	$1,075,800	$961,700	$651,150	$1,144,356	$5,341,518	$3,659,929				
Expanded Blue Box	tonnes	62,893	62,893	62,893	16,300	16,300	26,046	6,087	86,988	86,988				
	cost ($)	$4,779,868	$3,962,259	$1,698,111	$1,075,800	$961,700	$651,150	$1,144,356	$4,697,352	$3,218,556				
Wet/Dry	tonnes		62,893	62,893		16,300	26,046	6,087		69,063		166,181	166,181	17,925
	cost ($)		$3,962,259	$1,698,111		$961,700	$651,150	$1,144,356		$2,555,331		$21,603,530	$12,463,575	$1,075,500
Mixed Waste Processing	tonnes	26,805	26,805	45,059	16,300	16,300	26,046	6,087	123,076		123,076			
	cost ($)	$2,037,180	$1,688,715	$1,216,597	$1,075,800	$961,700	$651,150	$1,144,356	$6,646,104		$16,615,260			
- compost landfilled	tonnes									73,430				
	cost ($)									$2,716,909				
- compost marketed	tonnes									42,038				
	cost ($)									$1,555,410				

Notes:

- Blue Box Collection cost based on $319.011/4196 tonnes ($76/tonne) for Richmond Hill, 1992
- Blue Box processing cost based on $261259/4196 tonnes ($62/t - processing + truck rental) for Richmond Hill. A capital cost of $25/tonne is assumed and added to give $87/tonne
- Yard Waste collection cost based on $129,933/1967 tonnes ($66/tonne) for Richmond Hill, 1992
- Yard Waste processing cost based on $35/tonne for Richmond Hill

Backyard Composter D version @ 240 kg/composter

Table C.4
Summary of Updated Residential System Costs
Region of York

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	28	$3,112,980	$3,245,336	$6,358,316	$7,676,100	$5,259,550	$12,935,650	$19,293,966	$113	$39	$119
2	Existing/ Committed	28	$3,112,980	$3,245,336	$6,358,316	$7,676,100	$5,259,550	$12,935,650	$19,293,966	$113	$39	$119
3	User Pay	50	$4,949,140	$4,591,946	$9,541,086	$5,341,518	$3,659,929	$9,001,447	$18,542,533	$96	$59	$115
4	Expanded Blue Box	56	$5,855,668	$5,021,354	$10,877,022	$4,697,352	$3,218,556	$7,915,908	$18,792,930	$98	$67	$116
5A	Wet/Dry (H)	65	$12,625,340	$6,096,854	$18,722,194	$8,978,190	$2,555,331	$11,533,521	$30,255,715	$145	$116	$187
5B	Wet/Dry (L)	65	$7,283,850	$6,096,854	$13,380,704	$5,179,725	$2,555,331	$7,735,056	$21,115,760	$104	$83	$131
6	Mixed Waste Processing	71-89	$3,112,980	$3,229,324	$22,957,564	$6,646,104	$2,716,909 to $1,555,410	$9,363,013 to $8,201,514	$32,320,577 to $31,159,078	$147 $184	$142	$200 $193
			MSW Processing	$16,615,260								

No. of Households = 161,556

Notes
1 See Table C.1 for derivation of costs
2 Refer to Service Technical Appendix for diversion estimates
3 System costs divided by 161,556 households in Region of York in 1992

SCHEDULE D

REGION OF PEEL ESTIMATES

Table D.1

Original Unit Costs and Cost Estimates (Low Disposal Rate)
Region of Peel

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	B.Y. Comp. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	MSW Processing	Wet/Dry Collection
Unit Cost	($/t)	$100	$50	$22	$74	$55	$25	$100	$60	$70	$150	$75
Existing	tonnes	37,454	37,454	37,454	7,661	7,661	13,641	5,246	253,329	253,329		
	cost ($)	$3,745,400	$1,872,700	$823,988	$566,914	$421,355	$341,025	$524,600	$15,199,740	$17,733,030		
Existing/ Committed	tonnes	41,204	41,204	41,204	7,661	8,161	16,521	11,996	239,449	239,449		
	cost($)	$4,120,400	$2,060,200	$906,488	$566,914	$448,855	$413,025	$1,199,600	$14,366,940	$16,761,430		
Direct Cost	tonnes	85,184	85,184	85,184	22,175	22,675	28,293	9,506	172,546	172,546		
	cost ($)	$8,518,400	$4,259,200	$1,874,048	$1,640,950	$1,247,125	$707,325	$950,600	$10,352,760	$12,078,220		
Expanded Blue Box	tonnes	103,318	103,318	103,318	7,661	8,161	28,293	11,996	165,564	165,564		
	cost ($)	$10,331,800	$5,165,900	$2,272,996	$566,914	$448,855	$707,325	$1,199,600	$9,933,840	$11,589,480		
Wet/Dry	tonnes		103,318	103,318		61,933	28,293	11,996		111,791		277,042
	cost ($)		$5,165,900	$2,272,996		$3,406,315	$707,325	$1,199,600		$7,825,370		$20,778,150
Mixed Waste Processing	tonnes	41,204	41,204	65,191	7,661	8,161	28,293	11,996	227,677		227,677	
	cost ($)	$4,120,400	$2,060,200	$1,434,191	$566,914	$448,855	$707,325	$1,199,600	$13,660,620		$34,151,550	
- compost landfilled	tonnes									107,844		
	cost ($)									$7,549,045		
- compost marketed	tonnes									35,983		
	cost ($)									$2,518,810		

Notes:
1. See Service Technical Appendix for derivation of tonnages managed by different methods
2. See Tables 3.15 and 3.16 for updated diversion estimates and costs

Garbage Disposal cost @ $70/tonne
Backyard composter diversion @ 240 kg/composter

Table D.2

Summary of Original Residential System Costs (Low Disposal Rate)
Region of Peel

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	20	$4,312,314	$2,335,692	$6,648,006	$15,199,740	$17,733,030	$32,932,770	$39,580,776	$104	$28	$165
2	Existing/ Committed	25	$4,687,314	$3,215,192	$7,902,506	$14,366,940	$16,761,430	$31,128,370	$39,030,876	$101	$33	$162
3	Direct Cost	46	$10,159,350	$5,290,202	$15,449,552	$10,352,760	$12,078,220	$22,430,980	$37,880,532	$106	$64	$158
4	Expanded Blue Box	48	$10,898,714	$5,248,684	$16,147,398	$9,933,840	$11,589,480	$21,523,320	$37,670,718	$106	$67	$157
5	Wet/Dry	65	$12,393,825	$8,206,144	$20,599,969	$8,384,325	$7,825,370	$16,209,695	$36,809,664	$100	$86	$153
6	Mixed Waste Processing	66-89	$4,687,314	$3,485,506	$42,324,370	$13,660,620	$2,518,810 to $7,549,045	$16,179,430 to $21,209,665	$58,503,800 to $63,534,035	$150 $202	$176	$244 $264
			MSW Processing	$34,151,550								

Notes:
1 See Table 3.13 for derivation of costs
2 See Tables 3.15 and 3.16 for updated cost and diversion estimates

Updated Unit Costs and Cost Estimates
Region of Peel

System		Blue Box Collection	Blue Box Processing	Blue Box Revenue	Yard Waste Collection	Yard Waste Processing	Backyard Compost. Net	Other Waste Diverted	Garbage Collection	Garbage Disposal	Mixed Waste Processing	High Wet/Dry Collection	Low Wet/Dry Collection	Wet Composting
Unit Cost	($/t)	$125	$56	$26	$74	$55	$25	$140	$40	$70	$123	$130	$90	$60
Existing	tonnes	37,454	37,454	37,454	7,661	7,661	13,641	5,246	253,329	253,329				
	cost ($)	$4,681,750	$2,097,424	$973,804	$566,914	$421,355	$341,025	$734,440	$10,133,160	$17,733,030				
Existing/	tonnes	41,204	41,204	41,204	7,661	8,161	16,521	11,996	239,449	239,449				
Committed	cost($)	$5,150,500	$2,307,424	$1,071,304	$566,914	$448,855	$413,025	$1,679,440	$9,577,960	$16,761,430				
User Pay	tonnes	85,653	85,653	85,653	22,175	22,675	28,293	11,996	168,715	168,715				
	cost ($)	$10,706,625	$4,796,568	$2,226,978	$1,640,950	$1,247,125	$707,325	$1,679,440	$6,748,600	$11,810,050				
Expanded	tonnes	103,318	103,318	103,318	7,661	8,161	28,293	11,996	165,564	165,564				
Blue Box	cost ($)	$12,914,750	$5,785,808	$2,686,268	$566,914	$448,855	$707,325	$1,679,440	$6,622,560	$11,589,480				
Wet/Dry	tonnes		103,318	103,318		22,675	28,293	11,996		111,791		277,043	277,043	39,259
	cost ($)		$5,785,808	$2,686,268		$1,247,125	$707,325	$1,679,440		$7,825,370		$36,015,590	$24,933,870	$2,355,540
Mixed Waste	tonnes	41,204	41,204	71,503	7,661	8,161	28,293	11,996	227,677		227,677			
Processing	cost ($)	$5,150,500	$2,307,424	$1,859,065	$566,914	$448,855	$707,325	$1,679,440	$9,107,080		$28,004,271			
- compost	tonnes									134,657				
landfilled	cost ($)									$9,425,975				
- compost	tonnes									71,935				
marketed	cost ($)									$5,035,462				

Notes:
- Blue Box Collection cost is $125/tonne (Williams, 1993)
- Blue Box Processing cost is $56/tonne (Williams, 1993), processing net of revenue is $30/tonne.
- Blue Box Revenue based on information for Region of Durham (Revenues for Peel not broken out in budget)
- Yard Waste collection cost based on Etobicoke cost of $74/tonne for bagged leaf and yard waste.
- Yard Waste processing based on $22/tonne capital, $33/tonne operating (for Waterloo, Ontario; Ortech International, 1993).
  This is similar to Hensall Composting Facility ($40-60/tonne, without pre-processing).
- Other Waste Diverted cost - RIS estimate based on discussions with Region of Peel - cost is between $100 and $188/tonne (Williams, 1993).
- Garbage Collection cost based on discussions with Region of Peel (Williams, 1993)
- Garbage Disposal cost ($70 - Landfill; $98 - Incineration), based on discussions with Region of Peel (Williams, 1993)
- High Wet/Dry Collection cost based on Markham Wet/Dry study (including bins) - $130/tonne (LURA Group, 1993)
- Low Wet/Dry Collection cost estimated to be $75/tonne, plus $15/tonne for bins (considered reasonable by Region of Peel staff)

Garbage Disposal cost @ $70/tonne
Backyard composter diversion @ 240 kg/composter

Table D.4
Summary of Updated Residential System Costs
Region of Peel

Residential System No.	System Description	Diversion (%)	Diversion System Costs			Disposal System Costs			Total System Cost	Diversion System Costs		Total System Cost
			Collection	Processing	Total	Collection	Disposal	Total		$/tonne diverted	$/hhld	$/hhld
1	Existing	20	$5,248,664	$2,620,440	$7,869,104	$10,133,160	$17,733,030	$27,866,190	$35,735,294	$123	$33	$149
2	Existing/ Committed	25	$5,717,414	$3,777,440	$9,494,854	$9,577,960	$16,761,430	$26,339,390	$35,834,244	$123	$40	$149
3	User Pay	47	$12,347,575	$6,203,480	$18,551,055	$6,748,600	$11,810,050	$18,558,650	$37,109,705	$125	$77	$154
4	Expanded Blue Box	48	$13,481,664	$5,935,160	$19,416,824	$6,622,560	$11,589,480	$18,212,040	$37,628,864	$128	$81	$157
5A	Wet/Dry (H)	65	$21,482,760	$9,088,970	$30,571,730	$14,532,830	$7,825,370	$22,358,200	$52,929,930	$149	$127	$220
5B	Wet/Dry (L)	65	$14,872,680	$9,088,970	$23,961,650	$10,061,190	$7,825,370	$17,886,560	$41,848,210	$117	$100	$174
6	Mixed Waste Processing	66-89	$5,717,414	$3,259,992	$36,981,677	$9,107,080	$9,425,975 to $5,035,462	$18,533,055 to $14,142,542	$55,514,732 to $51,124,219	$151 $203	$154	$231 $213
			MSW Processing	$28,004,271								

No. of Households = 240,228

Notes:
See Table D 1 for derivation of costs
2. Refer to Service Technical Appendix for diversion estimates
3. System costs divided by 240, 228 residents in Peel Region , 1992

SCHEDULE E

RESIDENTIAL NET EFFECTS TABLES

TABLE DR. 1
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Durham

SYSTEM: Existing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$35/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$35/hh/yr (diversion system)	• least expensive based on diversion system (same as existing/committed)
	$105 - $140/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$105 - $140/hh/yr	• expensive based on total system

Schedule E
Durham-System Net Effects
$/HH/yr.

TABLE DR. 2
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Durham

SYSTEM: Existing/Committed

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$35/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$35/hh/yr (diversion system)	• least expensive based on diversion system (same as existing)
	$104 - $139/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$104 - $139/hh/yr (total system)	• expensive based on total cost

Schedule E
Durham-System Net Effects
$/HH/yr.

TABLE DR. 3
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Durham

SYSTEM: Direct Cost

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$56/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$56/hh/yr (diversion system)	• moderately expensive based on diversion system
	$106 - $132/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$106 - $132/hh/yr (total system)	• least expensive based on total system

Schedule E
Durham-System Net Effects
$/HH/yr.

TABLE DR. 4
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Durham

SYSTEM: Expanded Blue Box

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$67/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$67/hh/yr (diversion system)	• moderately expensive based on diversion system
	$112 - 135/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$112 - $135/hh/yr (total system)	• moderately expensive based on total system

Schedule E
Durham-System Net Effects
$/HH/yr.

TABLE DR. 5
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Durham

SYSTEM: Wet/Dry

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$76/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$76/hh/yr (diversion system)	• expensive based on diversion system
	$115 - $133/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$115 - $133/hh/yr (total system)	• moderately expensive based on total system

Schedule E
Durham-System Net Effects
$/HH/yr.

TABLE DR. 6
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Durham

SYSTEM: Mixed Waste Processing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$130/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$130/hh/yr (diversion system)	• most expensive based on diversion system
	$171-193/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$171-193/hh/yr (total system)	• most expensive based on total system

Schedule E
Durham-System Net Effects
$/HH/yr.

TABLE MR. 1
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Metro Toronto

SYSTEM: Existing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$35/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$35/hh/yr (diversion system)	• least expensive based on diversion system (same as existing/committed)
	$131-$174/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$131-$174/hh/yr	• least-or second least expensive based on total system (same as existing/ committed)

Schedule E
Metro Toronto-System Net Effects
$/HH/yr.

TABLE MR. 2
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: MetroToronto

SYSTEM: Existing/Committed

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$38/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$38/hh/yr (diversion system)	• second least expensive based on diversion system
	$132-$174/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$132-$174/hh/yr (total system)	• least to second least expensive based on total cost (similar to existing)

Schedule E
Metro Toronto-System Net Effects
$/HH/yr.

TABLE MR. 3
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: MetroToronto

SYSTEM: Direct Cost

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$76/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$76/hh/yr (diversion system)	• moderately expensive based on diversion system
	$146-$177/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$146-$177/hh/yr (total system)	• moderately expensive based on total system

Schedule E
Metro Toronto-System Net Effects
$/HH/yr.

TABLE MR. 4
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: MetroToronto

SYSTEM: Expanded Blue Box

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$90/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$90/hh/yr (diversion system)	• second most expensive based on diversion system
	$153-$180/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$153-$180/hh/yr (total system)	• second most expensive based on total system

Schedule E
Metro Toronto-System Net Effects
$/HH/yr.

TABLE MR. 5
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: MetroToronto

SYSTEM: Wet/Dry

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$90/hh/yr (diversion system) $143-$214/hh/yr (total system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages • increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$90/hh/yr (diversion system) $143-$214/hh/yr (total system)	• second most expensive (same as expanded blue box) based on diversion system • second least or least expensive based on total system

Schedule E
Metro Toronto-System Net Effects
$/HH/yr.

TABLE MR. 6
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: MetroToronto

SYSTEM: Mixed Waste Processing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$175/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$175/hh/yr (diversion system)	• most expensive based on diversion system
	$237-$244/hh/yr (total system) $247-$266	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$237-$244/hh/yr (total system) $247-$266	• most expensive based on total system

Schedule E
Metro Toronto-System Net Effects
$/HH/yr.

TABLE YR. 1
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: York

SYSTEM: Existing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$40/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$40/hh/yr (diversion system)	• least expensive based on diversion system (same as existing/committed)
	$128-163/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$128-163/hh/yr	• mid-range preferred based on total system (same as existing/ committed)

Schedule E
York Region-System Net Effects
$/HH/yr.

TABLE YR. 2
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: York

SYSTEM: Existing/Committed

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$40/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$40/hh/yr (diversion system)	• least expensive based on diversion system
	$128-$163/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$128-$163/hh/yr (total system)	• mid-range expensive based on total cost (similar to existing)

Schedule E
York Region-System Net Effects
$/HH/yr.

TABLE YR. 3
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: York

SYSTEM: Direct Cost

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$62/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$62/hh/yr (diversion system)	• moderately expensive based on diversion system
	$124-$148/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$124-$148/hh/yr (total system)	• least expensive based on total system

Schedule E
York Region-System Net Effects
$/HH/yr.

TABLE YR. 4
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: York

SYSTEM: Expanded Blue Box

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$72/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$72/hh/yr (diversion system)	• moderately expensive based on diversion system
	$126-$147/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$126-$147/hh/yr (total system)	• least expensive based on total system

Schedule E
York Region-System Net Effects
$/HH/yr.

TABLE YR. 5
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: York

SYSTEM: Wet/Dry

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$118/hh/yr (diversion system) $134-$207/hh/yr (total system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages • increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$118/hh/yr (diversion system) $134-$207/hh/yr (total system)	• second most expensive (same as expanded blue box) based on diversion system • second most expensive based on total system

Schedule E
York Region-System Net Effects
$/HH/yr.

TABLE YR. 6
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: York

SYSTEM: Mixed Waste Processing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$154/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$154/hh/yr (diversion system)	• most expensive based on diversion system
	$205-$210/hh/yr (total system) $214-$229	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$205-$210/hh/yr (total system) $214-$229	• most expensive based on total system

Schedule E
York Region-System Net Effects
$/HH/yr.

TABLE PR. 1
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Peel

SYSTEM: Existing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$28/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$28/hh/yr (diversion system)	• least expensive based on diversion system (same as existing/committed)
	$133-$175/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$133-$175/hh/yr	• least-moderately expensive based on total system (same as existing/ committed)

Schedule E
Peel Region-System Net Effects
$/HH/yr.

TABLE PR. 2
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Peel

SYSTEM: Existing/Committed

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$33/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$33/hh/yr (diversion system)	• second least expensive based on diversion system
	$133-$172/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$133-$172/hh/yr (total system)	• least to moderately expensive based on total cost (similar to existing)

Schedule E
Peel Region-System Net Effects
$/HH/yr.

TABLE PR. 3
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Peel

SYSTEM: Direct Cost

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$64/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$64/hh/yr (diversion system)	• moderately expensive based on diversion system
	$136-$165/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$136-$165/hh/yr (total system)	• moderately expensive based on total system

Schedule E
Peel Region-System Net Effects
$/HH/yr.

TABLE PR. 4
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Peel

SYSTEM: Expanded Blue Box

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$67/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$67/hh/yr (diversion system)	• moderately expensive based on diversion system
	$136-$164/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$136-$164/hh/yr (total system)	• moderately expensive based on total system

Schedule E
Peel Region-System Net Effects
$/HH/yr.

TABLE PR. 5
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Peel

SYSTEM: Wet/Dry

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$86/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$86/hh/yr (diversion system)	• second most expensive based on diversion system
	$139-$158/hh/yr (total system)	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$139-$158/hh/yr (total system)	• moderately expensive based on total system

Schedule E
Peel Region-System Net Effects
$/HH/yr.

TABLE PR. 6
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: Peel

SYSTEM: Mixed Waste Processing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Household				
Indicator – $/hh/yr	$176/hh/yr (diversion system)	• improve system efficiency • decrease disposal tonnages • increase recycling tonnages	$176/hh/yr (diversion system)	• most expensive based on diversion system
	$239-$245/hh/yr (total system) $251-$269/hh/yr	• increase use of backyard composters • increase source separation of yard waste • increase promotion and education	$239-$245/hh/yr (total system) $251-$269/hh/yr	• most expensive based on total system

Schedule E
Peel Region-System Net Effects
$/HH/yr.

SCHEDULE F

IC&I GENERIC NET EFFECTS TABLES

GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I Existing
CRITERIA GROUP: Cost
CRITERIA: Cost per Tonne Diverted
INDICATOR: $ per Tonne Diverted

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection – Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators. • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers. • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces. • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• average of $50/tonne for collection of IC&I dry wastes • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials reduces the cost of collection and processing services although space, staff and storage bins are required	• average of $50/tonne for collection of IC&I dry wastes

TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I Existing
CRITERIA GROUP: Cost
CRITERIA: Cost per Tonne Diverted
INDICATOR: $ per Tonne Diverted

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection – Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators. • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers. • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces. • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• average of $50/tonne for collection of IC&I dry wastes • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials reduces the cost of collection and processing services although space, staff and storage bins are required	• average of $50/tonne for collection of IC&I dry wastes

IC&I Collection – Wet Wastes • Voluntary source separation of IC&I wet wastes. • Separate collection of IC&I wet wastes	• an average of $50/tonne for collection • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection	• higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• an average of $50/tonne for collection
IC&I Processing – Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's. • Processing of IC&I sector recyclables by small private sector recyclers	• processing costs depend on waste material, volumes and handling program • tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes. • some plastics likely have a significantly higher cost for processing due to market value and technical limitations. A representative cost of approximately $280/tonne has been assumed for this analysis. Some sources have suggested much higher costs. • In municipally-run MRFs, cost typically are in the range of $40 to $80 per tonne	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes.

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• $75/tonne price for windrow composting based on charges at Scotts Farm and other municipally-run composting facilities	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • market development for finished compost and larger volumes may lower costs • good source separation will improve compost quality	• $75/tonne price for windrow composting
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • Landspreading of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• informal reuse occurs at low cost • reuse centres may operate at approximately $50/tonne (to be confirmed) • food wastes may be collected at zero cost to the IC&I generator for use as animal feed (confirm)	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• reuse costs are expected to be relatively low

IC&I Reduction • Voluntary waste reduction actions by IC&I generators. • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP)	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems for monitoring source reduction costs	• limited available data
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low

Schedule F
IC&I Existing System
Cost/Tonne

IC&I Promotion & Education • IC&I information hotline (Metro). • Promotion/education program focused on reducing waste disposed by the IC&I sector, carried out by the regional municipality. • Promotion/education of IC&I waste reduction by non-profit organizations (e.g. RCO) • Promotion/education of IC&I waste reduction by associations	• costs are relatively low, typically a few dollars per employee per year • for in-house activities, existing infrastructure may be used, such as newsletters and bulletins for promotion of waste reduction initiatives	• valuable enhancement to improve performance of systems	• considered to be relatively low cost

Schedule F
TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I Existing
CRITERIA GROUP: Cost
CRITERIA: Total System Cost
INDICATOR: Total System $

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection – Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators. • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers. • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces. • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• dry recyclables total collection cost based on unit cost of approximately $50/tonne multiplied by the quantities of dry materials recovered • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials reduces the cost of collection and processing services although space, staff and storage bins are required	• total collection cost for dry recyclables based on unit cost of approximately $50/tonne multiplied by the quantities of dry materials recovered • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)

IC&I Collection – Wet Wastes • Voluntary source separation of IC&I wet wastes. • Separate collection of IC&I wet wastes	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)	higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)
IC&I Processing – Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's. • Processing of IC&I sector recyclables by small private sector recyclers	• tipping/handling fees and processing costs charged to generators depend on waste material, volumes and handling program • total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee (one reason why unit cost for mixed waste relatively high)	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	• total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • this may be high as other markets involving different processing methods may have lower associated costs to the generator • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • strong market revenues for finished compost would lower cost • good source separation will improve compost quality	cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• costs estimated to be relatively low	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• costs expected to be low

IC&I Reduction • Voluntary waste reduction actions by IC&I generators. • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP).	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems to monitor source reduction costs	• limited cost data available
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low

IC&I Promotion & Education • IC&I information hotline (Metro). • Promotion/education program focused on reducing waste disposed by the IC&I sector, carried out by the regional municipality. • Promotion/education of IC&I waste reduction by non-profit organizations (e.g. RCO) • Promotion/education of IC&I waste reduction by associations	• costs are relatively low, typically a few dollars per employee per year • for in-house activities, existing infrastructure may be used, such as newsletters and bulletins for promotion of waste reduction initiatives	• valuable enhancement to improve performance of systems	• considered to be relatively low cost

Schedule F
TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I Existing/Committed
CRITERIA GROUP: Cost
CRITERIA: Cost per Tonne Diverted
INDICATOR: $ per Tonne Diverted

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection – Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators. • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers. • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces. • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• average of $50/tonne for collection of IC&I dry wastes • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials reduces the cost of collection and processing services although space, staff and storage bins are required	• average of $50/tonne for collection of IC&I dry wastes

IC&I Collection – Wet Wastes • Voluntary source separation of IC&I wet wastes. • Separate collection of IC&I wet wastes	• an average of $50/tonne for collection • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection	• higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• an average of $50/tonne for collection
IC&I Processing – Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's. • Processing of IC&I sector recyclables by small private sector recyclers	• processing costs depend on waste material, volumes and handling program • tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes. • some plastics likely have a significantly higher cost for processing due to market value and technical limitations. A representative cost of approximately $280/tonne has been assumed for this analysis. Some sources have suggested much higher costs. • In municipally-run MRFs, cost typically are in the range of $40 to $80 per tonne	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes.

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• $75/tonne price for windrow composting based on charges at Scotts Farm and other municipally-run composting facilities	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • market development for finished compost and larger volumes may lower costs • good source separation will improve compost quality	• $75/tonne price for windrow composting
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • Landspreading of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• informal reuse occurs at low cost • reuse centres may operate at approximately $50/tonne (to be confirmed) • food wastes may be collected at zero cost to the IC&I generator for use as animal feed (confirm)	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• reuse costs are expected to be relatively low

IC&I Reduction • Voluntary waste reduction actions by IC&I generators. • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP)	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems for monitoring source reduction costs	• limited available data
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low

Schedule F
IC&I Existing/Committed System
Cost/Tonne

IC&I Promotion & Education • IC&I information hotline (Metro). • Promotion/education program focused on reducing waste disposed by the IC&I sector, carried out by the regional municipality. • Promotion/education of IC&I waste reduction by non-profit organizations (e.g. RCO) • Promotion/education of IC&I waste reduction by associations	• costs are relatively low, typically a few dollars per employee per year • for in-house activities, existing infrastructure may be used, such as newsletters and bulletins for promotion of waste reduction initiatives	• valuable enhancement to improve performance of systems	• considered to be relativeiy low cost

Schedule F
TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I Existing/Committed
CRITERIA GROUP: Cost
CRITERIA: Total System Cost
INDICATOR: Total System $

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection – Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators. • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces. • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• dry recyclables total collection cost based on unit cost of approximately $50/tonne multiplied by the quantities of dry materials recovered • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials reduces the cost of collection and processing services although space, staff and storage bins are required	• total collection cost for dry recyclables based on unit cost of approximately $50/tonne multiplied by the quantities of dry materials recovered • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)

IC&I Collection – Wet Wastes • Voluntary source separation of IC&I wet wastes. • Separate collection of IC&I wet wastes	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)	higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)
IC&I Processing – Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's. • Processing of IC&I sector recyclables by small private sector recyclers	• tipping/handling fees and processing costs charged to generators depend on waste material, volumes and handling program • total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee (one reason why unit cost for mixed waste relatively high)	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	• total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • this may be high as other markets involving different processing methods may have lower associated costs to the generator • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • strong market revenues for finished compost would lower cost • good source separation will improve compost quality	cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• costs estimated to be relatively low	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• costs expected to be low

IC&I Reduction • Voluntary waste reduction actions by IC&I generators. • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP).	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems to monitor source reduction costs	• limited cost data available
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low

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Schedule F
TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I Expanded 3Rs Regulations
CRITERIA GROUP: Cost
CRITERIA: Cost per Tonne Diverted
INDICATOR: $ per Tonne Diverted

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection – Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators. • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers. • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces. • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• average of $50/tonne for collection of IC&I dry wastes • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials reduces the cost of collection and processing services although space, staff and storage bins are required	• average of $50/tonne for collection of IC&I dry wastes

IC&I Collection - Wet Wastes • Voluntary source separation of IC&I wet wastes • Separate collection of IC&I wet wastes	• an average of $50/tonne for collection • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection	• higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• an average of $50/tonne for collection
IC&I Processing - Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's • Processing of IC&I sector recyclables by small private sector recyclers	• processing costs depend on waste material, volumes and handling program • tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes. • some plastics likely have a significantly higher cost for processing due to market value and technical limitations. A representative cost of approximately $280/tonne has been assumed for this analysis. Some sources have suggested much higher costs. • In municipally-run MRFs, cost typically are in the range of $40 to $80 per tonne	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes.

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• $75/tonne price for windrow composting based on charges at Scotts Farm and other municipally-run composting facilities	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • market development for finished compost and larger volumes may lower costs • good source separation will improve compost quality	• $75/tonne price for windrow composting
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • Landspreading of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• informal reuse occurs at low cost • reuse centres may operate at approximately $50/tonne (to be confirmed) • food wastes may be collected at zero cost to the IC&I generator for use as animal feed (confirm)	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• reuse costs are expected to be relatively low

IC&I Reduction • Voluntary waste reduction actions by IC&I generators • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP).	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems for monitoring source reduction costs	• limited available data
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low

Schedule F
TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I Extended 3Rs Regulations
CRITERIA GROUP: Cost
CRITERIA: Total System Cost
INDICATOR: Total System $

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
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IC&I Collection – Wet Wastes • Voluntary source separation of IC&I wet wastes • Separate collection of IC&I wet wastes	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)	higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)
IC&I Processing – Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's • Processing of IC&I sector recyclables by small private sector recyclers	• tipping/handling fees and processing costs charged to generators depend on waste material, volumes and handling program • total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee (one reason why unit cost for mixed waste relatively high)	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	• total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • this may be high as other markets involving different processing methods may have lower associated costs to the generator • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • strong market revenues for finished compost would lower cost • good source separation will improve compost quality	cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• costs estimated to be relatively low	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• costs expected to be low

IC&I Reduction • Voluntary waste reduction actions by IC&I generators • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP)	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems to monitor source reduction costs	• limited cost data available
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low
IC&I Promotion & Education • IC&I information hotline (Metro). • Promotion/education program focused on reducing waste disposed by the IC&I sector, carried out by the regional municipality • Promotion/education of IC&I waste reduction by non-profit organizations (e.g. RCO) • Promotion/education of IC&I waste reduction by associations	• costs are relatively low, typically a few dollars per employee per year • for in-house activities, existing infrastructure may be used, such as newsletters and bulletins for promotion of waste reduction initiatives	• valuable enhancement to improve performance of systems	• considered to be relatively low cost

Schedule F
IC&I Extended 3Rs Regulations System
Total System Cost

Schedule F
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IC&I Collection – Wet Wastes • Voluntary source separation of IC&I wet wastes • Separate collection of IC&I wet wastes	• an average of $50/tonne for collection • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection	• higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• an average of $50/tonne for collection
IC&I Processing – Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's. • Processing of IC&I sector recyclables by small private sector recyclers	• processing costs depend on waste material, volumes and handling program • tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes. • some plastics likely have a significantly higher cost for processing due to market value and technical limitations. A representative cost of approximately $280/tonne has been assumed for this analysis. Some sources have suggested much higher costs. • In municipally-run MRFs, cost typically are in the range of $40 to $80 per tonne	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes

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IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • Landspreading of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• informal reuse occurs at low cost • reuse centres may operate at approximately $50/tonne (to be confirmed) • food wastes may be collected at zero cost to the IC&I generator for use as animal feed (confirm)	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• reuse costs are expected to be relatively low

IC&I Reduction • Voluntary waste reduction actions by IC&I generators. • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP).	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems for monitoring source reduction costs	• limited available data
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low

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Schedule F
IC&I Extended 3Rs Regulations System
Cost/Tonne

IC&I Promotion & Education • IC&I information hotline (Metro). • Promotion/education program focused on reducing waste disposed by the IC&I sector, carried out by the regional municipality. • Promotion/education of IC&I waste reduction by non-profit organizations (e.g. RCO) • Promotion/education of IC&I waste reduction by associations	• costs are relatively low, typically a few dollars per employee per year • for in-house activities, existing infrastructure may be used, such as newsletters and bulletins for promotion of waste reduction initiatives	• valuable enhancement to improve performance of systems	• considered to be relatively low cost

Schedule F
TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I Expanded 3Rs Regulations
CRITERIA GROUP: Cost
CRITERIA: Total System Cost
INDICATOR: Total System $

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection – Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators. • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers. • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• dry recyclables total collection cost based on unit cost of approximately $50/tonne multiplied by the quantities of dry materials recovered • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials reduces the cost of collection and processing services although space, staff and storage bins are required	• total collection cost for dry recyclables based on unit cost of approximately $50/tonne multiplied by the quantities of dry materials recovered • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)

IC&I Collection – Wet Wastes • Voluntary source separation of IC&I wet wastes. • Separate collection of IC&I wet wastes	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)	higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)
IC&I Processing – Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's. • Processing of IC&I sector recyclables by small private sector recyclers	• tipping/handling fees and processing costs charged to generators depend on waste material, volumes and handling program • total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee (one reason why unit cost for mixed waste relatively high)	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	• total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • this may be high as other markets involving different processing methods may have lower associated costs to the generator • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • strong market revenues for finished compost would lower cost • good source separation will improve compost quality	cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets)	• costs estimated to be relatively low	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• costs expected to be low

Schedule F
IC&I Expanded 3Rs Regulations with Organics System
Total System Cost

IC&I Reduction • Voluntary waste reduction actions by IC&I generators. • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP).	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems to monitor source reduction costs	• limited cost data available
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low

IC&I Promotion & Education • IC&I information hotline (Metro) • Promotion/education program focused on reducing waste disposed by the IC&I sector, carried out by the regional municipality. • Promotion/education of IC&I waste reduction by non-profit organizations (e.g. RCO) • Promotion/education of IC&I waste reduction by associations	• costs are relatively low, typically a few dollars per employee per year • for in-house activities, existing infrastructure may be used, such as newsletters and bulletins for promotion of waste reduction initiatives	• valuable enhancement to improve performance of systems	• considered to be relatively low cost

Schedule F
TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I No Unprocessed Waste to Landfill
CRITERIA GROUP: Cost
CRITERIA: Cost per Tonne Diverted
INDICATOR: $ per Tonne Diverted

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection – Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators. • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers. • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces. • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• average of $50/tonne for collection of IC&I dry wastes • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances • various programs likely would be established including the collection of source separated materials and garbage as well as programs which involve collection of mixed wastes with limited source separation (possibly only wet dry) to be processed at another facility • programs would depend on the particular circumstances of the generator, storage space, types and quantities of waste materials generated	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials may reduce the cost of collection and processing services although space, staff and storage bins are required	• average of $50/tonne for collection of IC&I dry wastes

IC&I Collection - Wet Wastes • Voluntary source separation of IC&I wet wastes • Separate collection of IC&I wet wastes	• an average of $50/tonne for collection • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection	• higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• an average of $50/tonne for collection
IC&I Processing - Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord) • Processing of IC&I sector recyclables in municipal MRF's. • Processing of IC&I sector recyclables by small private sector recyclers	• processing costs depend on waste material, volumes and handling program • tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes. • costs will depend on the type of program as well as the type of materials. Handling of mixed wastes, which involves more processing by processors and recyclers, likely would involve a higher collection/disposal price charged to the generator • some plastics likely have a significantly higher cost for processing due to market value and technical limitations. A representative cost of approximately $280/tonne has been assumed for this analysis. Some sources have suggested much higher costs. • In municipally-run MRFs, cost typically are in the range of $40 to $80 per tonne	• market development may have a positive effect on costs of processing charged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	tipping/handling fees charged to generators vary from approximately $40/tonne for OCC to $115/tonne for mixed wastes.

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• $75/tonne price for windrow composting based on charges at Scotts Farm and other municipally-run composting facilities	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • market development for finished compost and larger volumes may lower costs • good source separation will improve compost quality	• $50 to $75/tonne price for windrow composting
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • Landspreading of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• informal reuse occurs at low cost • reuse centres may operate at approximately $50/tonne (to be confirmed) • food wastes may be collected at zero cost to the IC&I generator for use as animal feed (confirm)	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• reuse costs are expected to be relatively low

IC&I Reduction • Voluntary waste reduction actions by IC &I generators • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP)	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems for monitoring source reduction costs	• limited available data
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low

Schedule F
IC&I No Unprocessed Waste to Landfill System
Cost/Tonne

IC&I Promotion & Education • IC&I information hotline (Metro). • Promotion/education program focused on reducing waste disposed by the IC&I sector, carried out by the regional municipality. • Promotion/education of IC&I waste reduction by non-profit organizations (e.g. RCO) • Promotion/education of IC&I waste reduction by associations	• costs are relatively low, typically a few dollars per employee per year • for in-house activities, existing infrastructure may be used, such as newsletters and bulletins for promotion of waste reduction initiatives	• valuable enhancement to improve performance of systems	• considered to be relatively low cost

Schedule F
TABLE 1
GENERIC SYSTEM NET EFFECTS TABLE BY COMPONENT

SYSTEM: IC&I No Unprocessed Waste to Landfill
CRITERIA GROUP: Cost
CRITERIA: Total System Cost
INDICATOR: Total System $

Component Category/ Components	Component Environmental Effects	Mitigation/ Enhancement	Component Net Effects
IC&I Collection - Dry Wastes • Voluntary source separation of dry recyclables by some IC&I generators • Collection of source separated dry recyclables from the IC&I sector by private sector haulers and recyclers • Curbside collection of IC&I recyclables in some areas (City of Toronto, Caledon) by municipal forces • IC&I depots at transfer stations for use by small business generators • Landfill bans on specified materials (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).	• dry recyclables total collection cost based on unit cost of approximately $50/tonne multiplied by the quantities of dry materials recovered • some materials have a high market value such that collection costs are covered by hauler/recycler in some circumstances • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes) • various programs likely would be established including the collection of source separated materials and garbage as well as collection of mixed wastes with limited source separation (possibly only wet dry) to be processed at another facility • programs would depend on the particular circumstances of the generator, storage space, types and quantities of waste materials generated	• larger generators can realize cost economies with roll-off bins or front-end loader service • source separating materials may reduce the cost of collection and processing services although space, staff and storage bins are required	• total collection cost for dry recyclables based on unit cost of approximately $50/tonne multiplied by the quantities of dry materials recovered • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)

IC&I Collection – Wet Wastes • Voluntary source separation of IC&I wet wastes. • Separate collection of IC&I wet wastes	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • in some cases a higher rate may be charged for food wastes due to high density • higher costs may be incurred as food wastes may require more frequent collection • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)	higher volumes allow economies of scale to be realized by specific establishments (different storage/collection methods) • higher volumes collected in general may lower costs to all generators	• wet organics collection cost based on unit cost of approximately $50/tonne multiplied by the quantity of wet organics collected • cost of collection of garbage (not source separated) is based on a unit collection cost of approximately $50/tonne multiplied by the quantity of garbage collected (# tonnes)

IC&I Processing – Dry Wastes • Processing of specific dry materials (e.g. C&D wastes, wood, drywall etc.) in specially designed facilities • Processing centres for a wide range of dry recyclables collected from the IC&I sector, owned by the private sector and operated by private sector staff (e.g. Laidlaw MRF, Mississauga WMI MRF, Etobicoke or BFI MRF, Concord). • Processing of IC&I sector recyclables in municipal MRF's. • Processing of IC&I sector recyclables by small private sector recyclers	• tipping/handling fees and processing costs charged to generators depend on waste material, volumes and the type of handling program • total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed. • cost of disposing residues assumed to be included in tipping fee (one reason why unit cost for mixed waste relatively high) • various programs likely would be established including the collection of source separated materials and garbage as well as programs which involve collection of mixed wastes with limited source separation (possibly only wet dry) to be processed at another facility • programs would depend on the particular circumstances of the generator, storage space, types and quantities of waste materials generated	• market development may have a positive effect on costs of processing chaged to IC&I waste generators • processing larger volumes of wastes may allow economies of scale to be passed on to IC&I waste generators	• total cost of processing dry recyclables based on unit costs for processing different materials (varying from $40/tonne for OCC to $115/tonne for mixed wastes) multiplied by the quantities of each material processed • cost of disposing residues assumed to be included in tipping fee

IC&I Processing – Wet Wastes • Centralized windrow composting of source-separated IC&I organics (Scotts Farm). • On-site composting of source separated organics generated by the IC&I sector. • Centralized composting of IC&I organics in in-vessel system. • Vermicomposting at some IC&I locations. • Rendering of food wastes from IC&I sector.	• cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • this may be high as other markets involving different processing methods may have lower associated costs to the generator • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne	• windrow composting is a cost-effective method; • in-vessel options may have higher costs though economies of scale may be realized and reflected in the price charged to IC&I generators • operational improvements may lower costs • strong market revenues for finished compost would lower cost • good source separation will improve compost quality	• cost of processing wet wastes based on the unit cost of processing at a centralized facility such as Scotts Farm (approximately $75/tonne) multiplied by the quantity of wet organics processed • cost of disposing rejected residues or of unmarketable product, if any, assumed to be included in the price of $75/tonne
IC&I Reuse • Reuse by IC&I generators, through the Canadian, Provincial (e.g. Ontario Waste Exchange) and local waste exchange programs (e.g. Durham). • Community-based reuse programs for small IC&I generators (WASTEWISE, Halton). • Use of food wastes as animal feed. • Use of food waste for human consumption. • of IC&I organics • Refilling of IC&I containers and packaging refillable bottles refillable pails or drums. • Use of re-usable packaging (e.g. reusable plastic and wood pallets).	• costs estimated to be relatively low	• higher volumes likely would have a positive effect of lowering prices charged to IC&I generators	• costs expected to be low

IC&I Reduction • Voluntary waste reduction actions by IC&I generators. • Voluntary reduction of packaging waste by 25% by the year 2000 (NAPP).	• difficult to assign a cost to waste reduction initiatives as they can be very diverse and little information is available. • costs may include investment in research (audits and technology development), substitution of more costly materials, shorter shelf-life of non-durable consumer goods which may require more costly operational regimes (retail/wholesale sectors), and others	• Develop systems to monitor source reduction costs	• limited cost data available
IC&I Programs • Voluntary waste audits performed by IC&I generators. • Independent voluntary waste reduction programs in private companies. • Voluntary packaging reporting by packaging users (NAPP)	• waste audits and workplans are site and establishment-specific even for larger corporations. • audits may cost between $2500 and $50,000/facility, depending on the size and diversity of activities • For smaller establishments the absolute costs may be less • packaging audits are generally more costly as information on external factors such as recycled content of purchased materials is required.	• provision of support and advisory services may provide cost efficiencies for individual establishments	• costs are expected to be relatively low
IC&I Promotion & Education • IC&I information hotline (Metro). • Promotion/education program focused on reducing waste disposed by the IC&I sector, carried out by the regional municipality. • Promotion/education of IC&I waste reduction by non-profit organizations (e.g. RCO) • Promotion/education of IC&I waste reduction by associations	• costs are relatively low, typically a few dollars per employee per year • for in-house activities, existing infrastructure may be used, such as newsletters and bulletins for promotion of waste reduction initiatives	• valuable enhancement to improve performance of systems	• considered to be relatively low cost

Schedule F
IC&I No Unprocessed Waste to Landfill System
Total System Cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Existing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Tonne Diverted				
Indicator – $/tonne diverted	$110	• substitute recycling tonnages for disposal tonnages (recycling cost lower than disposal cost for some materials such as fibres, wood) • economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation • market development will lower costs	$110	• relatively low diversion cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Existing/Committed

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Tonne Diverted				
Indicator – $/tonne diverted	$112- $114	• substitute recycling tonnages for disposal tonnages (recycling cost lower than disposal cost for some materials such as fibres, wood) • economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation • market development will lower costs	$112-$114	• essentially same as existing system diversion cost

Schedule F
GTA System Net Effects
$/Tonne Diverted

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Extended 3Rs Regulations

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Tonne Diverted				
Indicator – $/tonne diverted	$115	• substitute recycling tonnages for disposal tonnages (recycling cost lower than disposal cost for some materials such as fibres, wood) • economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation of those not included in regulations - less significant than in Systems 1 and 2 • increase promotion and education to affect greatest compliance • market development will lower costs	$115	• essentially same as existing system diversion cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Expanded 3Rs Regulations

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Tonne Diverted				
Indicator – $/tonne diverted	$117	• economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation of those not included in regulations - less significant than in Systems 1and 2 • increase promotion and education to affect greatest compliance • market development will lower costs	$117	• essentially same as existing system diversion cost

Schedule F
GTA System Net Effects
$/Tonne Diverted

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Expanded 3Rs Regulations with Organics

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Tonne Diverted				
Indicator – $/tonne diverted	$117	• economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation of those not included in regulations - less significant than in Systems 1 and 2 • increase promotion and education to affect greatest compliance • market development will lower costs	$117	• essentially same as existing system diversion cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: No Unprocessed Waste to Landfill

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Cost per Tonne Diverted				
Indicator – $/tonne diverted	$185	• economies of scale of recovery could lower costs • increase promotion and education to affect greatest compliance • market development will lower costs • possible cost benefits from encouraging greatest amount of source separation within range of options • disposal costs are included in diversion cost since all waste assumed collected for processing or at least, for handling by processing facilities.	$185	• most expensive of waste management systems

Schedule F
GTA System Net Effects
$/Tonne Diverted

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Existing

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Total System Cost				
Indicator – $ Total System	$367million	• substitute recycling tonnages for disposal tonnages (recycling cost lower than disposal cost for some materials such as fibres, wood) • economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation • market development will lower costs	$367million	• relatively low total system cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Existing/Committed

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Total System Cost				
Indicator – $ Total System	$362million - $368million	• depends in part on capture rate of regulations - higher capture rate yields lower cost due to substitution of lower cost recycling for disposal for many materials • economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation • market development will lower costs	$362million - $368million	• essentially same as existing system total cost

Schedule F
GTA System Net Effects
Total System Cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Extended 3Rs Regulations

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Total System Cost				
Indicator – $ Total System	$358million	• substitute recycling tonnages for disposal tonnages (recycling cost lower than disposal cost for some materials such as fibres, wood) • economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation of those not included in regulations - less significant than in Systems 1 and 2 • increase promotion and education to affect greatest compliance • market development will lower costs	$358million	• essentially same as existing system total cost

Schedule F
GTA System Net Effects
Total System Cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Expanded 3Rs Regulations

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Total System Cost				
Indicator – $ Total System	$355million	• economies of scale of recovery could lower costs (not considered in this analysis) • increase promotion and education to affect greater voluntary participation of those not included in regulations - less significant than in Systems 1and 2 • increase promotion and education to affect greatest compliance • market development will lower costs	$355million	• essentially same as existing system total cost

Schedule F
GTA System Net Effects
Total System Cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: IC&I Expanded 3Rs Regulations with Organics

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Total System Cost				
Indicator – $ Total System	$354million	• economies of scale of recovery could lower costs • increase promotion and education to affect greater voluntary participation of those not included in regulations - less significant than in Systems 1 and 2 • increase promotion and education to affect greatest compliance • market development will lower costs	$354million	• essentially same as existing system total cost

TABLE 2
GTA ICI SYSTEMS
SYSTEM NET EFFECTS TABLE

REGIONAL MUNICIPALITY: GTA

SYSTEM: No Unprocessed Waste to Landfill

Criteria/Indicator	Effects by Indicator	Mitigation/ Enhancement	System Net Effects by Criterion	Advantages/ Disadvantages by Criterion
Criterion – Total System Cost				
Indicator – $ Total System	$419million	• economies of scale of recovery could lower costs • increase promotion and education to affect greatest compliance • market development will lower costs • possible cost benefits from encouraging greatest amount of source separation within range of options	$419million	• more expensive than existing system. • within accuracy of estimate should be considered essentially same as existing system total cost • also, possibly an overestimate given greater source separation may occur and garbage may be disposed of more cheaply than under assumptions used

Schedule F
GTA System Net Effects
Total System Cost